The Horrors of Nuclear War and How to Survive It!

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Prerequisites

The only prerequisites for understanding this presentation should only be high school chemistry, physics, and algebra. If you do not have these then maybe you might have a little trouble understanding some of the concepts but you should be able to understand the basics and get something out of the presentation anyway.

Purpose

The purpose of this presentation is to pass on information so you can make an informed decision in the event of a nuclear explosion and help you plan if you wish to. It is meant to pass all the ideas in one presentation and to be self-contained. In other words it is supposed to be thorough and accurate. It is not meant to be overwhelming and complicated. However, information on nuclear explosions by its

Purpose

very nature is complicated. Take away what you can and if needed revisit it over and over if necessary. Hopefully the information can be used to help you survive. This presentation does contain some of my opinions. Another purpose for this presentation is to try to take some of the fear and panic from such an event. Hopefully it will give you the confidence to deal with the known so the unknown

Purpose

will not overwhelm you. It is my hope that it could be passed along to everybody in the United States without cost to help you prepare in case an explosion occurs on American soil or if a nuclear reactor leaks radiation. It is meant to be more than just an outline but less than a book.

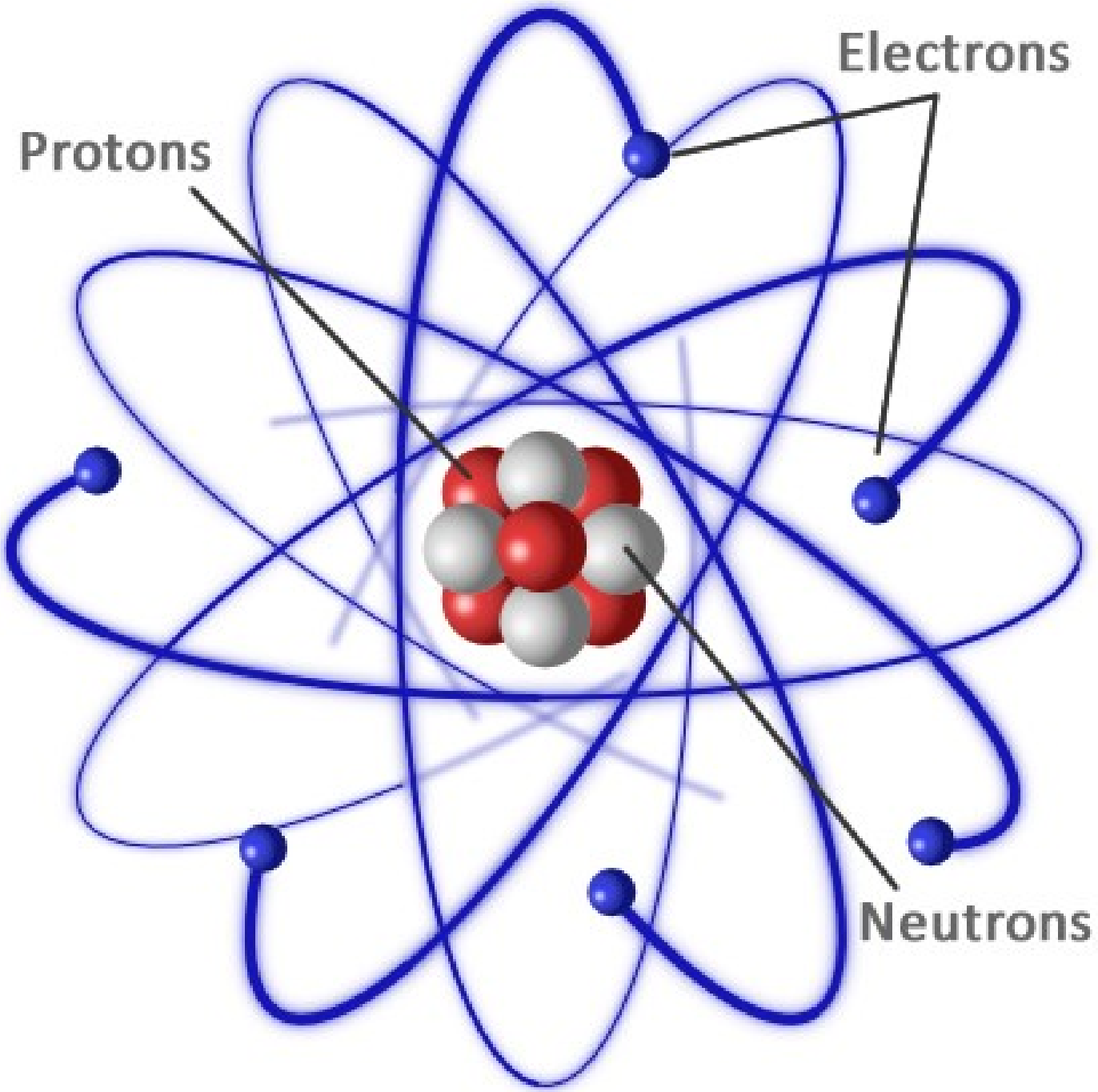
Section I: What is Radiation?
Section II: Fallout and Types of Blasts
Section III: Radiation Detectors and Other Electronic Equipment
Section IV: Our Risks, Biological Effects, and Protection
Section V: Summation

Section I

What is Radiation?

An Atom

An atom is made up of “essentially” three particles that we will discuss: electrons, protons, and neutrons. The nucleus is in the center of an atom and contains the protons and neutrons and the electrons orbit in different shells depending on how many electrons there are. For example a stable Carbon (C^{12}) atom contains six orbiting electrons and a nucleus that contains six protons and six neutrons.



This is a simplified picture of a typical atom.

An Unstable Atom

In an unstable atom there are more neutrons in the nucleus than the number of protons. An atom does not want to stay at this configuration because it is in a higher energy state. So it will go through neutron decay and give off the higher energy as radiation to become a stable atom. When talking about radiation, the number of neutrons and protons in the nucleus are more important when declaring it radioactive.

An Unstable Atom

For example, a C^{14} atom has six protons and eight neutrons. The two extra neutrons is what makes an atom radioactive and is called an isotope of Carbon. Many elements on the Periodic Table of Elements have isotopes. C^{14} is just one of them that I use as an example. There is also a Periodic Table of Isotopes that you can view on the internet that shows the many isotopes.

Types of Radiation

There are Three Types of Radiation:

- **α-Alpha Radiation**
- **β-Beta Radiation**
- **γ-Gamma Radiation**

We are going to be discussing gamma radiation and X-rays. Gamma radiation and X-rays are part of the electromagnetic spectrum (photons). They are considered waves and not particles like alpha and beta radiation. It can get confusing so try your best to understand the difference between electromagnetic radiation and just radiation. Light (photons) is considered a particle and a wave and that is just way beyond the scope of this discussion to get in a explanation why that is the case. Alpha and beta radiation will be discussed in a little more detail later. Just remember for now that alpha and beta radiation are NOT considered waves but particles.

Types of Radiation

Gamma and “soft” X-Ray electromagnetic radiation is given off during the nuclear explosion in a burst. Elements that give off gamma radiation persist. However, X-Rays are only given off during the immediate explosion. The alpha and beta radiations are also given off by the explosion. The elements that give off alpha and beta radiation can be deadly and can persist so be aware of them.

Types of Radiation

Alpha and beta radiation can be picked up in the growing crops and in the milk from animals. I understand you might want to eat crops and drink milk from animals if there is a extreme famine, but you should be careful when eating crops and drinking milk even in a famine. It is not without risk.

α-Radiation

- Is a helium nucleus. Notice: It does not have the electrons in the outer shells.
- Is Low Penetrating-a piece of paper or clothing can stop the helium nucleus.
- Not usually dangerous externally but if taken internally in the digestive system or lungs from contaminated food, water, or in the air they can be very dangerous.

β-Radiation

- It is an electron that has escaped a atom.
- Is Somewhat Penetrating-it can go through about a centimeter of tissue.
- Externally the beta radiation still can cause damage to the skin tissue and cause what looks like sunburns or burns including third degree burns, etc. They can cause skin cancer and if taken internally can be very dangerous.

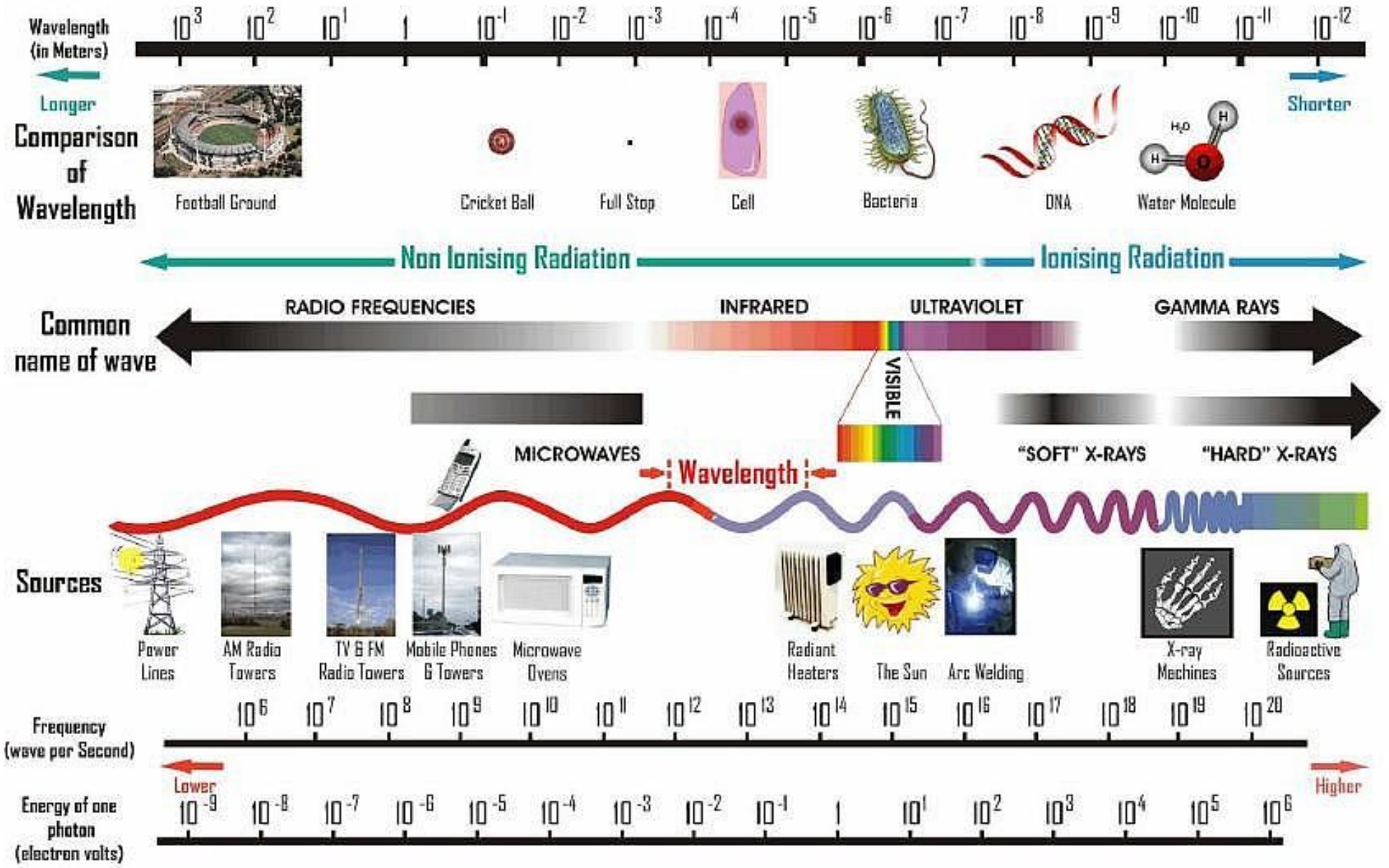
γ-Radiation

- Is a photon of electromagnetic energy and is more energetic than the other two radiations.
- Is Highly Penetrating-it can go through the body and it takes something dense to protect yourself like concrete or a decent amount of earth to stop it.
- Gamma radiation can cause damage to the genetic material inside of a cell causing the cell to die or become cancerous.

“Soft” X-Rays

- Are photons of electromagnetic energy and are also given off in a nuclear explosion. You can look at an electromagnetic spectrum and you will notice the “soft” x-rays are not as energetic as the gamma rays.
- Is Highly Penetrating-X-Rays can go through the body and it takes something dense to protect yourself like concrete or a decent amount of earth to stop it.
- X-Rays can cause damage to genetic material inside a cell causing the cell to die or become cancerous. However they only last during the immediate explosion and they do not persist.

THE ELECTROMAGNETIC SPECTRUM



Half-Life

The Half-Life is the measurement of the length of time for the amount of radiation (amount of radiation on the Geiger counter) to decrease by half. The measurement of radiation is continuous but it will decrease exactly by half by the time of the half-life. Each isotope has different half lives. The half-life of Pu^{239}, plutonium, is 24,110 years and the half-life of U^{235}, uranium, is 700 million years.

Half-Life

According to the “Effects of Nuclear Weapons” by Samuel Glasstone there are many fission products produced depending upon what is used in the weapon and other factors. Other isotopes or fission products have shorter or longer half-life's and not all of the fission products are isotopes.

Uranium

U^{235} is used in making a nuclear bomb. However, U^{238} makes up of over 99% of the uranium rock excavated. Using advanced centrifuges are a way to extract U^{235} from the U^{238}. So you may hear that a country is increasing it's number of centrifuges. That means they are wanting to produce higher concentrations of U^{235} for bombs or making more U^{235} to be used in nuclear reactors. They could really be using it in a nuclear reactor but if they don't have inspections by the international community nobody knows for sure.

Uranium

Since the centrifuges used in extracting more U^{235} require a certain degree of expertise and are sophisticated it takes experts to setup and monitor the centrifuges. One reason is because they are rotating very fast and if they are not calibrated correctly they will fly apart with great force. U^{238} can be used in a nuclear bomb however and it is used as a tamper in a thermonuclear weapon. Later in the presentation there will be graphics of nuclear bombs that will give more information and will show how U^{238} is used. However, U^{235} and Pu^{239} is used in the “Pit”.

Plutonium

Pu^{239} (Plutonium) is not found in any appreciative quantities naturally. It is a product of a specialized nuclear reactor. A nuclear reactor can benefit others by producing electricity for homes and businesses. So, radioactivity can be used for peaceful purposes. However, the US worries that a terrorist nation that has a nuclear reactor for peaceful purposes can use the plutonium created in or use the pretense to purify enough uranium using centrifuges to make nuclear weapons.

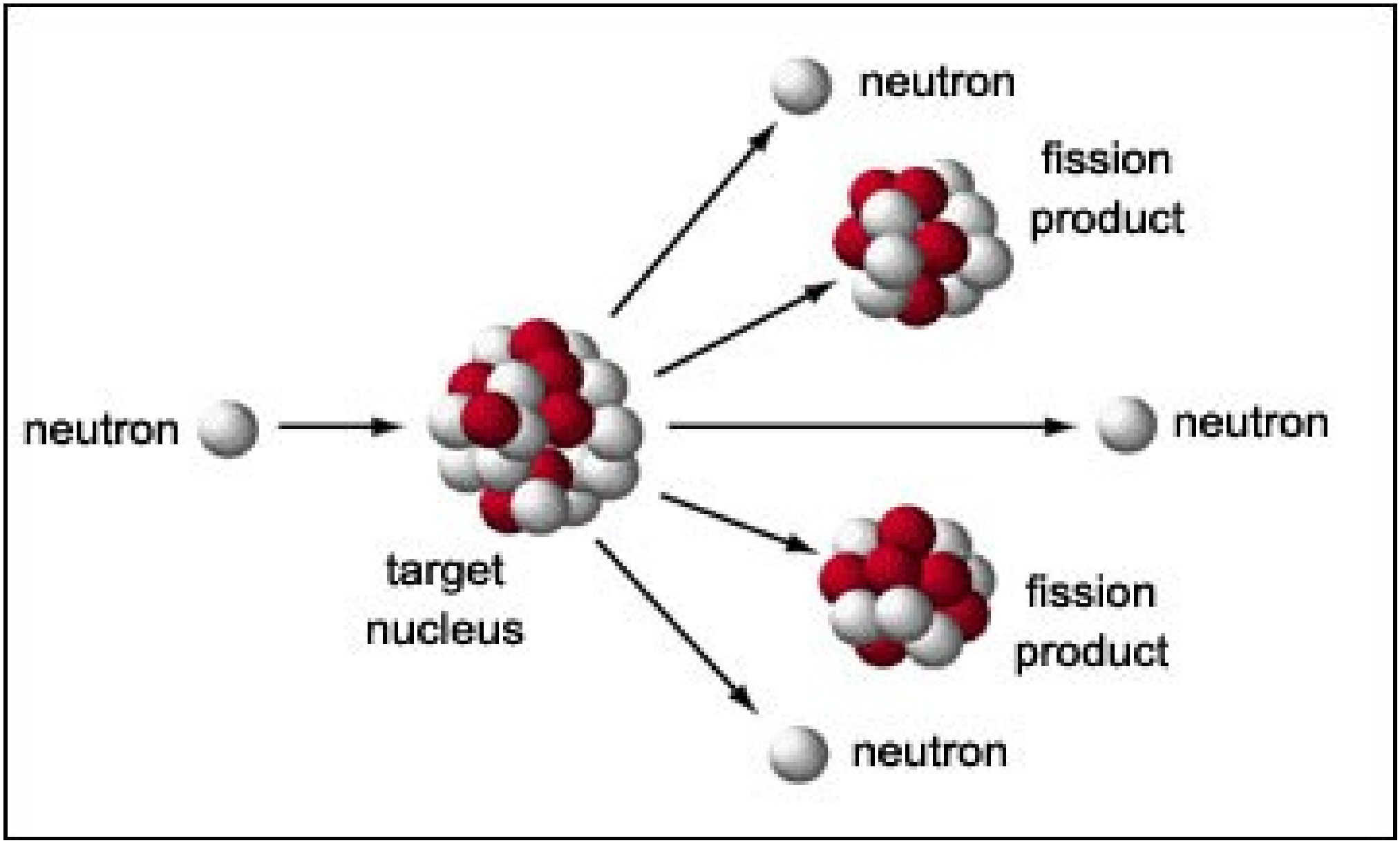
Section II

Fallout and Types of Blasts

This picture is of the characteristic mushroom cloud.

Fission Reaction

During fission when one neutron is knocked out of the nucleus of an isotope it can knock out 2 or 3 neutrons out of a isotope next to it. This can set up a self-sustaining cascade reaction and is what causes the release of a lot of energy in a nuclear explosion. A stored core in a bomb or missile produces less fissions to produce a sustained cascade reaction and is subcritical and this is how it is stored on a bomb or in storage without exploding.



This picture is of a fission reaction and its byproducts which are also radioactive until the number of protons equals the neutrons.

What You Can Find In A Bomb

- A implosion type bomb uses a high explosive covering over a uranium or plutonium sphere or “pit” and is set up to go off to create a spherical implosion.
- When an explosion occurs there are two forces at work. The outer explosives causing an implosion and the explosion caused by the energy given off by the cascading fission reactions. The idea is to keep the explosion from blowing the material so far apart that the cascade does not create a “supercriticality” or enough fission cascades to occur.

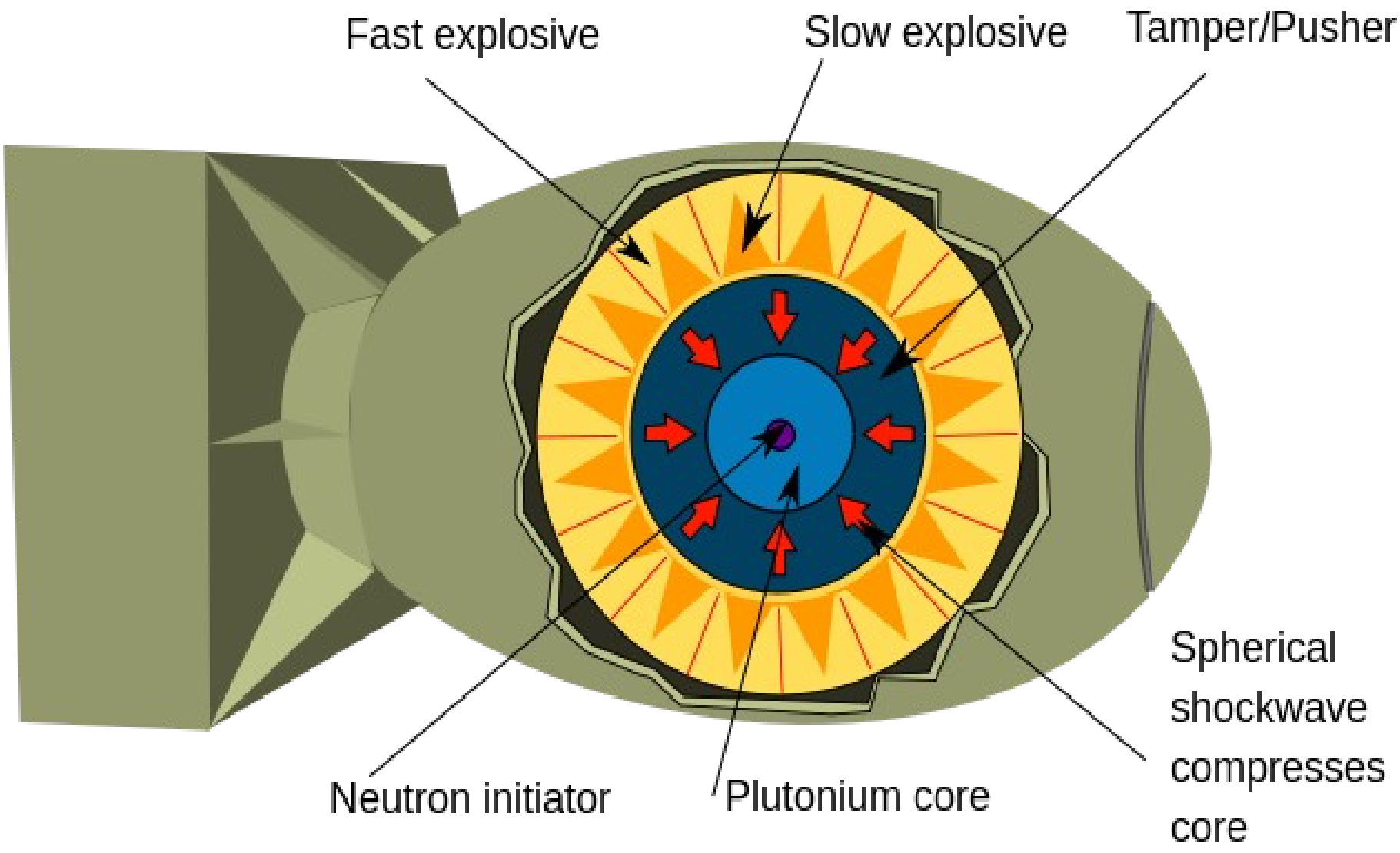
What You Can Find In A Bomb

- If the bomb explodes and the implosion does not create enough fission cascades in the uranium or plutonium then the bomb "fissiles" and you do not get the expected nuclear explosion.
- A tamper is used to slow down the implosion just enough so there are enough cascading fissions to cause a nuclear explosion before it is blown apart.
- A neutron initiator is used in a implosive explosion so that when the implosive shockwaves hit a beryllium and polonium

What You Can Find In A Bomb

core (or other variations) in the center of the pit it produces more neutrons. Helping the energy release or explosion.

- A neutron generator creates neutrons directed toward the isotope used in the bomb. Which is another way to help the cascading reaction.
- Mirrors are also used. They are not mirrors in the sense that you see your reflection in it but it reflects neutrons. Since this helps keep the neutrons available for the cascade reactions it increases the efficiency of the bomb.



This picture is of a typical atomic bomb.

Thermonuclear Reaction

In a thermonuclear burst there is a combination of a primary **fission** and a secondary **fusion** reaction. It causes a greater release of energy due to both of the reactions occurring. It is called a hydrogen bomb because hydrogen is used in the reaction. The hydrogen is provided by Deuterium (H^2) or Tritium (H^3) gas and Lithium-6 Deuteride fuels the fusion reaction.

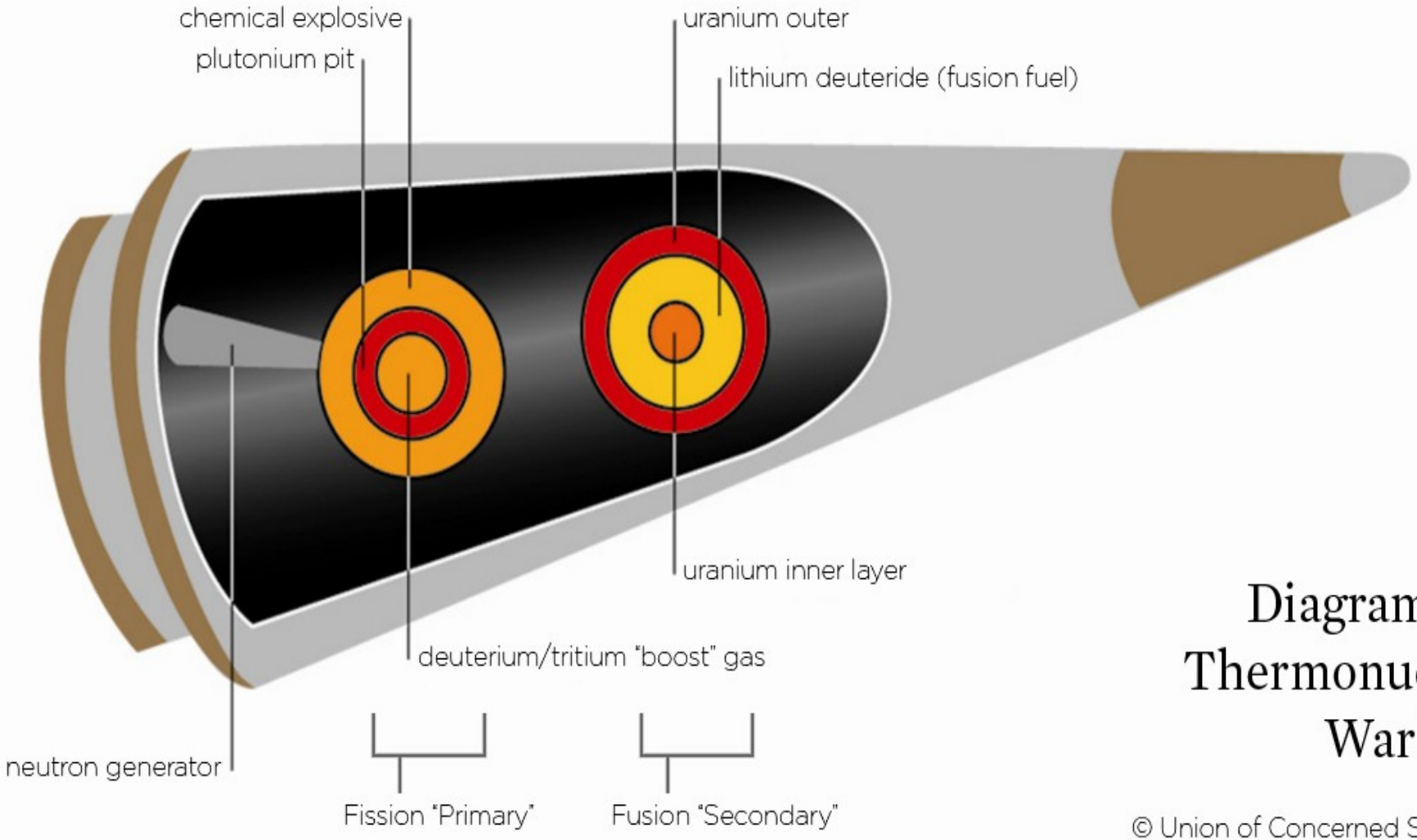
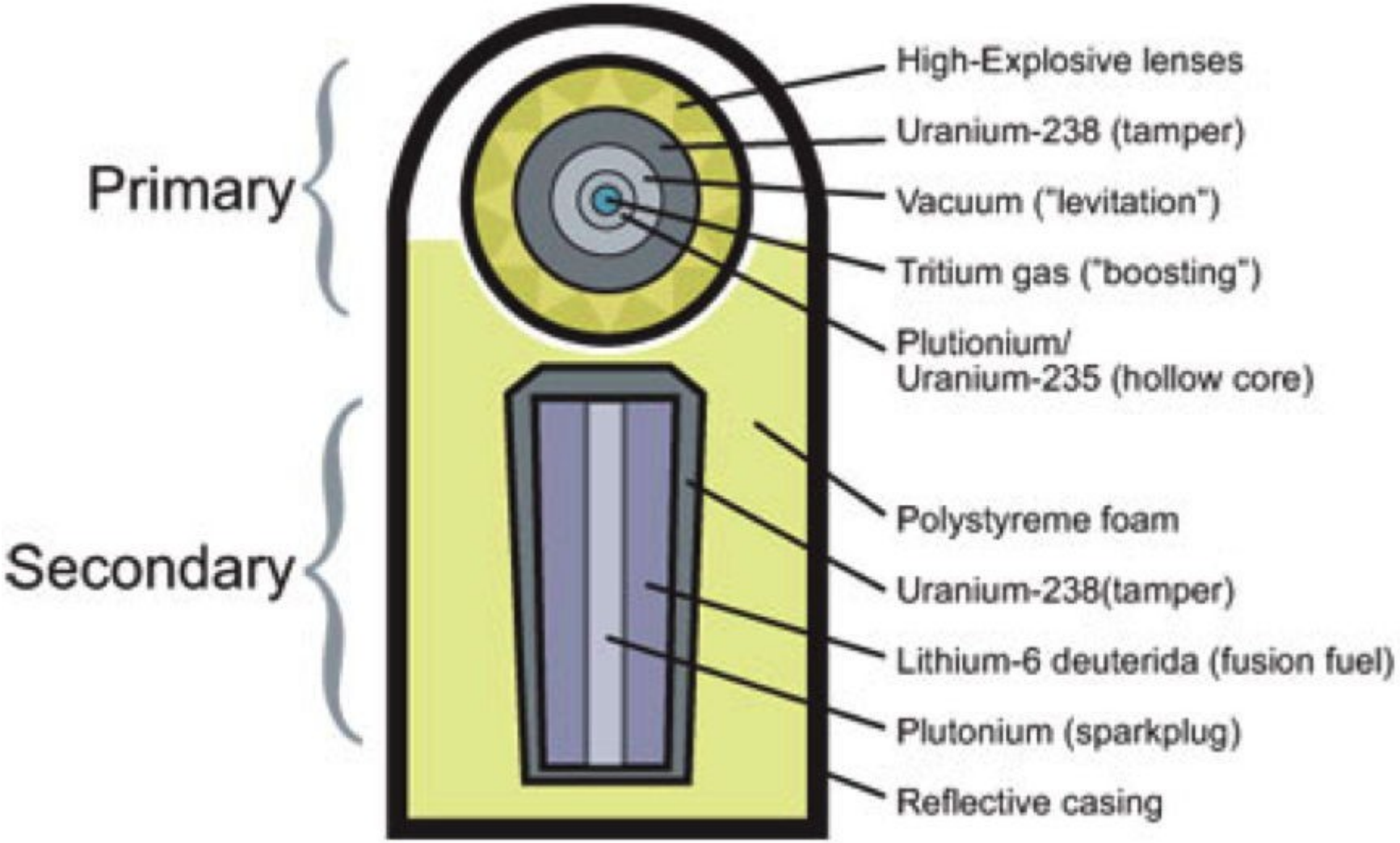


Diagram of a Thermonuclear Warhead

© Union of Concerned Scientists



This is another picture of a different type of thermonuclear bomb.

Fallout

During a nuclear blast the actual ground and objects on and near ground zero are vaporized due to the extreme heat and sucked up into a mushroom like cloud. This debris is mixed with unspent nuclear material from the bomb and the products of fission (even some of the fission products are radioactive) and are mixed together when they cool. There are also many high speed neutrons produced that can create radioactive isotopes in the debris. The metal around the device is also vaporized and mixes in with debris.

Fallout

As the temperature cools, the now radioactive debris, falls to the ground as **Fallout**. Fallout is spread out over a large area due to the winds carrying the radioactive debris. The heavier debris falls out closer to the actual blast due to its heavy weight. However, the lighter debris can be carried over a larger area and it can be carried for years if it is in the higher altitudes. Fallout is very hazardous so stay clear of it if at all possible. Shelter to prevent the radioactivity from the fallout to reach you and make you sick.

Energy Released

- In a fission reaction, about 1 pound of fissile material can release about 8 KT of energy.
- In a thermonuclear reaction, 1 pound of the hydrogen isotope deuterium can release about 26 KT of energy.

Remember these are dependent on a number of conditions like the isotopes used and the efficiency of the reaction. I believe these sizes were used in the bombs that were dropped on Japan during World War II. Given the higher efficiencies of the bombs now they are more than likely now inaccurate. It is for demonstration purposes.

Blast Characteristics

- **Initial Radiation**-5% of the energy created.
- **Residual Radiation**-10% of the energy created.
- **Thermal Energy**-35% of the energy created.
- **Over-Pressure**-50% of the energy created, Over-Pressure and Blast Wave.

Remember the characteristics are dependent on a lot of factors like the type of explosion used like fission or thermonuclear bombs. So the following percentages are approximate. Over-Pressure and Blast Wave are sometimes combined and called Shockwave. Initial Radiation and Residual Radiation are sometimes combined and just called Radiation.

Secondary Effects

- **Pooling of radioactivity-**radioactivity could pool in bodies of water due to rain washing it out. “Black rain” is the rain that falls to earth after an explosion, washing the fallout (black debris) out of the sky. So be careful of rivers, lakes, and oceans where the fallout can concentrate after a rain.
- **Nuclear Winter**-if there is enough material put into the atmosphere it could block the sun’s rays from reaching the earth and cause drops of temperature. This can kill crops and shorten the growing season, creating famine.

Secondary Effects

- **Earthquakes-**the nuclear explosions can cause earthquakes especially along fault lines.
- **Famine**-due to the destruction of the infrastructure, crops will not be able to be delivered where they are needed. Transportation will probably come to a stand still due to the EMP. Also famine can be due to radiation concentrating in plants where you have to discard crops or due to plant death due to lowering of temperatures (nuclear winter).

Secondary Effects

- **Pandemics**-due to the biological effects of radiation and the destruction of the infrastructure, manufacture, and distribution of medicines will make them hard to come by and normal infections that will not normally kill you will probably be more deadly.
- **Pestilence**-without pesticides, insects may have full rain over what crops are left and have no checks and balances. There will probably be an increase in insect population and then a die out due to lack of food sources.

Secondary Effects

- **Decreased Oxygen**-due to the fires and lack of plant life there will likely be localized or a general lack of oxygen levels. Especially in a full nuclear exchange. I have a handheld device that will read the O_2 and CO_2 levels in the environment. I have a few cans on O_2 in my first aid kit as well. Beware of the CO_2 levels in your shelter. Enough plants in your shelter can help mitigate your oxygen levels.
- **Increase of Toxicity Levels**-burning of chemicals and forests will increase toxic chemicals in the air and water. At a minimum you will need to filter the water and air intake from external sources. Make sure you have enough filters to last the duration of your sheltering and longer if necessary. NBC gas masks maybe helpful to remove some of the chemicals present in the air when you leave your shelter.

Initial Radiation

- About 5% of the energy is given off as initial radiation.
- The initial radiation is in the form of gamma rays/"soft" x-rays and is the result of the uranium or plutonium fission. The "soft" X-rays will be short lived but dangerous to those closest to the blast in the initial blast.

Residual Radiation

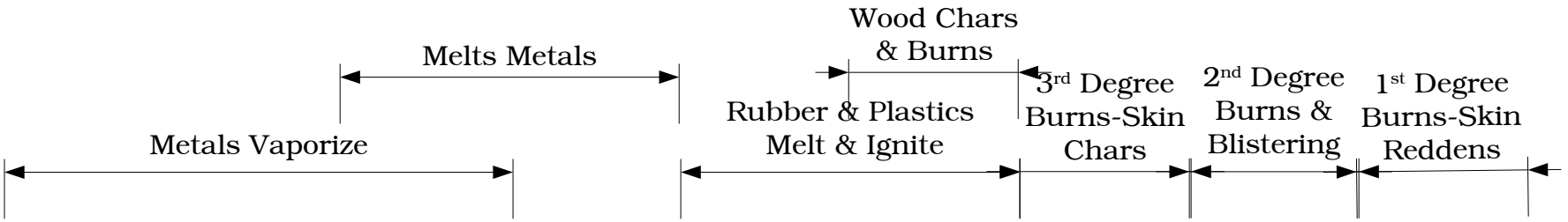
- About 10% of the energy is given of as residual radiation.
- The residual radiation is a combination of the radioactive vaporized debris, “unspent” free uranium/plutonium plus the byproducts of the fission/fusion from the explosion that are radioactive as well. This should be considered what makes the Fallout radioactive and hazardous.
- It would be useful to have Iodine tablets to take to help prevent Thyroid Cancer.

Thermal Energy

- About 35% of the energy is given off as thermal radiation or **heat**.
- The thermal radiation is in the tens of million degrees in the fireball (equal to the center of the sun).
- Photons or light is given off which can cause temporary or permanent blindness. So, do not look at the explosion.
- Burns caused by the thermal energy are going to be a problem. Items in your first aid kit should be for burns.

Thermal Energy

- The thermal radiation that is given off by the explosion and is the cause of combustible materials to catch fire and cause residual fires. Things like curtains can catch fire so a fire extinguisher or a bucket of sand can be used to put fires out in your home. I have fire blankets and fire extinguishers. Thermal energy will cause fires that might make the area hazardous until the fires die out. So sheltering in place may be impossible. Have a secondary location to evacuate to.



Weapons Yield									
10 KT	783 ft	1107 ft	1566 ft	2215 ft	3132 ft	4521 ft	1.2 mile	1.7 mile	2.9 mile
20 KT	1107 ft	1566 ft	2215 ft	3132 ft	4430 ft	1.2 mile	1.7 mile	2.2 mile	3.8 mile
50 KT	1751 ft	2476 ft	3502 ft	4953 ft	1.3 mile	1.9 mile	2.7 mile	3.6 mile	6.0 mile
100 KT	2476 ft	3502 ft	4953 ft	1.3 mile	1.8 mile	2.7 mile	3.6 mile	5.0 mile	8.5 mile
200 KT	3502 ft	4953 ft	1.3 mile	1.8 mile	2.6 mile	3.6 mile	5.0 mile	8.0 mile	11.9 mile
500 KT	1.0 mile	1.4 mile	2.0 mile	2.8 mile	3.9 mile	5.5 mile	8.5 mile	10.5 mile	18.5 mile
1 MT	1.5 mile	2.0 mile	2.8 mile	3.9 mile	5.9 mile	8.3 mile	10.7 mile	15.0 mile	25 mile
10 MT	4.3 mile	6.0 mile	8.5 mile	11.9 mile	16.0 mile	24.5 mile	33.0 mile	46.0 mile	80.0 mile
100 MT	13.0 mile	18.0 mile	25.5 mile	35.0 mile	50.0 mile	75.0 mile	112.0 mile	150.0 mile	255.0 mile

This woman has burn patterns left from the clothes she was wearing.

This picture is of the “shadow people”. The flash from the burst burned there shadow into the ground. One source said it was caused by the carbon in ones body.

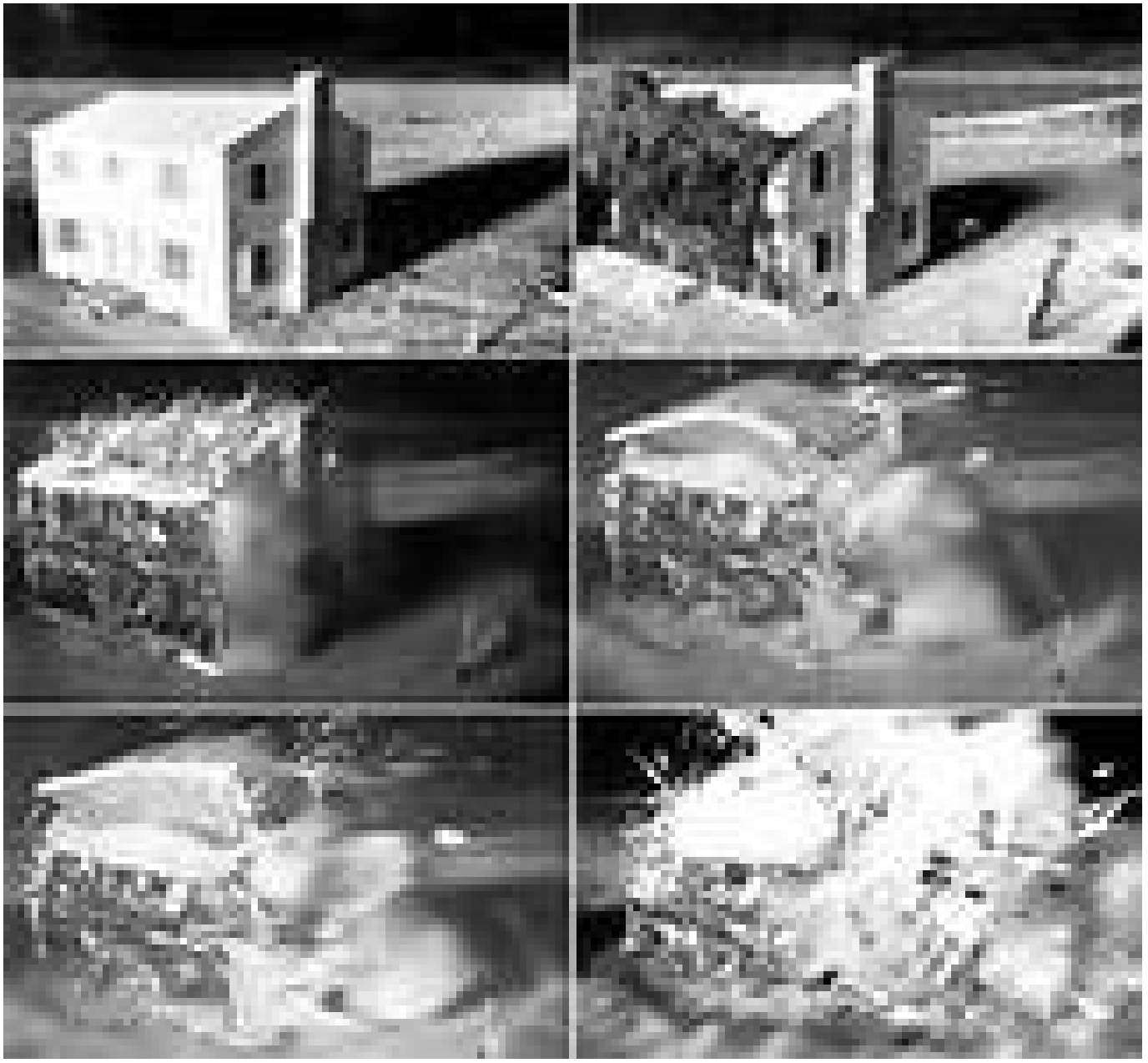
Over-Pressure

- About 50% of the energy from the blast creates the over-pressure and blast wave.
- Creates an increase in pressure usually given in pounds per square inch (PSI).
- Can create OVER 30 PSI near the blast and goes outward crushing buildings, people, etc. It does nasty things to the human body.
- Is somewhat analogous to the crushing pressure on objects deep in the ocean.

Blast Wave

- This is the high velocity winds created by the over-pressure and is given in miles per hour.
- This can create high velocity projectiles that are dangerous to humans, animals, plants, and buildings. These winds can cause all kinds of injuries due to flying debris. Having first aid supplies for broken bones and cuts is prudent.

Weapons Yield	30 PSI 670 mph	20 PSI 470 mph	15 PSI 380 mph	10 PSI 290 mph	7 PSI 225 mph	5 PSI 160 mph	3 PSI 116 mph	2 PSI 70 mph	1 PSI 48 mph
10 KT	1665 ft	2010 ft	2297 ft	2872 ft	3590 ft	4310 ft	1.0 mile	1.2 mile	2.1 mile
20 KT	2098 ft	2533 ft	2894 ft	3619 ft	4523 ft	1.0 mile	1.3 mile	1.6 mile	2.7 mile
50 KT	2848 ft	3438 ft	3928 ft	4912 ft	1.1 mile	1.3 mile	1.7 mile	2.1 mile	3.7 mile
100 KT	3587 ft	4330 ft	4947 ft	1.1 mile	1.4 mile	1.7 mile	2.2 mile	2.7 mile	4.6 mile
200 KT	4522 ft	1.0 mile	1.1 mile	1.4 mile	1.8 mile	2.2 mile	2.8 mile	3.4 mile	5.9 mile
500 KT	1.1 mile	1.4 mile	1.6 mile	2.0 mile	2.5 mile	3.0 mile	3.8 mile	4.7 mile	8.0 mile
1 MT	1.4 mile	1.8 mile	2.0 mile	2.5 mile	3.1 mile	3.8 mile	4.8 mile	5.9 mile	10.0 mile
10 MT	3.1 mile	3.8 mile	4.3 mile	5.4 mile	6.8 mile	8.2 mile	10.3 mile	12.8 mile	21.7 mile
100 MT	6.8 mile	8.2 mile	9.3 mile	11.7 mile	14.6 mile	17.6 mile	22.3 mile	27.5 mile	46.9 mile



These are pictures of what happened to one of the building during a test. This demonstrates how much damage the pressure and winds can cause.

Important Altitudes of Blasts

- High Altitude Burst
- Air Burst
- Surface Burst
- Other

A High Altitude Burst

- Will cause an electromagnetic pulse (EMP) over a large area. This causes a electronic circuit to short out which causes damage to radios, computers, cars, and other electronic devices. Faraday Cages are used to protect electronic equipment.
- It is a burst over 100,000 feet high.

Air Burst

- Has the greater initial radiation compared to a surface burst or high altitude burst.
- The bigger the difference between the fireball and the ground, the less amount of fallout there will be due to the smaller amount of material being vaporized and sucked into the mushroom cloud.
- It is considered a air burst if the fireball does not touch the ground.

This picture is suppose to represent an air burst. If you take radii from the center of the sphere you will notice that the gamma burst and heat will spread out more compared to a surface burst. With the fireball not directly hitting the ground, the energy will be able to spread out more and turns less of the ground into gaseous radioactive material thus creating less fallout.

Surface Burst

- Causes a larger amount fallout.
- Causes a crater that will be left after the burst.
- A burst on the surface produces the greatest over-pressure at very close ranges, but less over-pressure than a air burst at somewhat longer ranges. This is because more of the energy is being absorbed in ground and directed downward rather than outward. They say that the military will use this type of burst to dig out bunkers and nuclear weapons underground silos.

This picture represents a ground burst. Notice that the energy from the burst is absorbed into the ground and directed toward the ground. In this type of burst a lot of the material on the ground and the ground itself will be vaporized and become fallout.

This is an actual crater left from a surface burst from a test and is about a mile in diameter.

Other Types of Blasts

- **Water Burst**-It can cause a lot of steam and when cooled it will come down as radioactive rain. If exploded deep in the ocean like a trench away from a port it might cause a large tsunami. Russia threatened the United States will this type of blast. They say Russia has built and deployed some nuclear torpedoes. How well they work is debatable according to some.
- **Underground Burst**-There is a treaty preventing above ground testing due to the spreading of radioactivity all over the world and other hazards. There is also a ban on underground detonations. Now everything is simulated and theoretical.

MIRV's

Are (M)ultiple (I)ndependently targetable (R)e-entry (V)ehicles or MIRV's. In other words, it is an ICBM that carries multiple warheads that can hit different targets. There are also decoys on the missile used to make the odds of destroying an actual bomb less likely. That increases the chance that a bomb will actually hit the target even if you have a missile defense system.

This is a picture of a MIRV. What a scary thought.

Section III

Radiation Detectors and Other Electronic Equipment

These are pictures of some of my radiation detectors and dosimeters. Notice that two of them are electronic and one is not. Given some are electronic I have a few Geiger counters in Faraday Cages.

Conversions

Conversion Equivalence

1 curie = 3.7×10^{10} disintegrations per second		1 becquerel = 1 disintegration per second
1 millicurie (mCi)	=	37 megabecquerels (MBq)
1 rad	=	0.01 gray (Gy)
1 rem	=	0.01 sievert (Sv)
1 roentgen (R)	=	0.000258 coulomb/kilogram (C/kg)
1 megabecquerel (MBq)	=	0.027 millicuries (mCi)
1 gray (Gy)	=	100 rad
1 sievert (Sv)	=	100 rem
1 coulomb/kilogram (C/kg)	=	3,880 roentgens

Conversion Factors

To convert from	To	Multiply by
Curies (Ci)	becquerels (Bq)	3.7×10^{10}
millicuries (mCi)	megabecquerels (MBq)	37
microcuries (µCi)	megabecquerels (MBq)	0.037
millirads (mrad)	milligrays (mGy)	0.01
millirems (mrem)	microsieverts (µSv)	10
milliroentgens (mR)	microcoulombs/kilogram (µC/kg)	0.258
becquerels (Bq)	curies (Ci)	2.7×10^{-11}
megabecquerels (MBq)	millicuries (mCi)	0.027
megabecquerels (MBq)	microcuries (µCi)	27
milligrays (mGy)	millirads (mrad)	100
microsieverts (µSv)	millrems (mrem)	0.1
microcoulombs/kilogram (µC/kg)	milliroentgens (mR)	3.88

Why Do I Need A Detector?

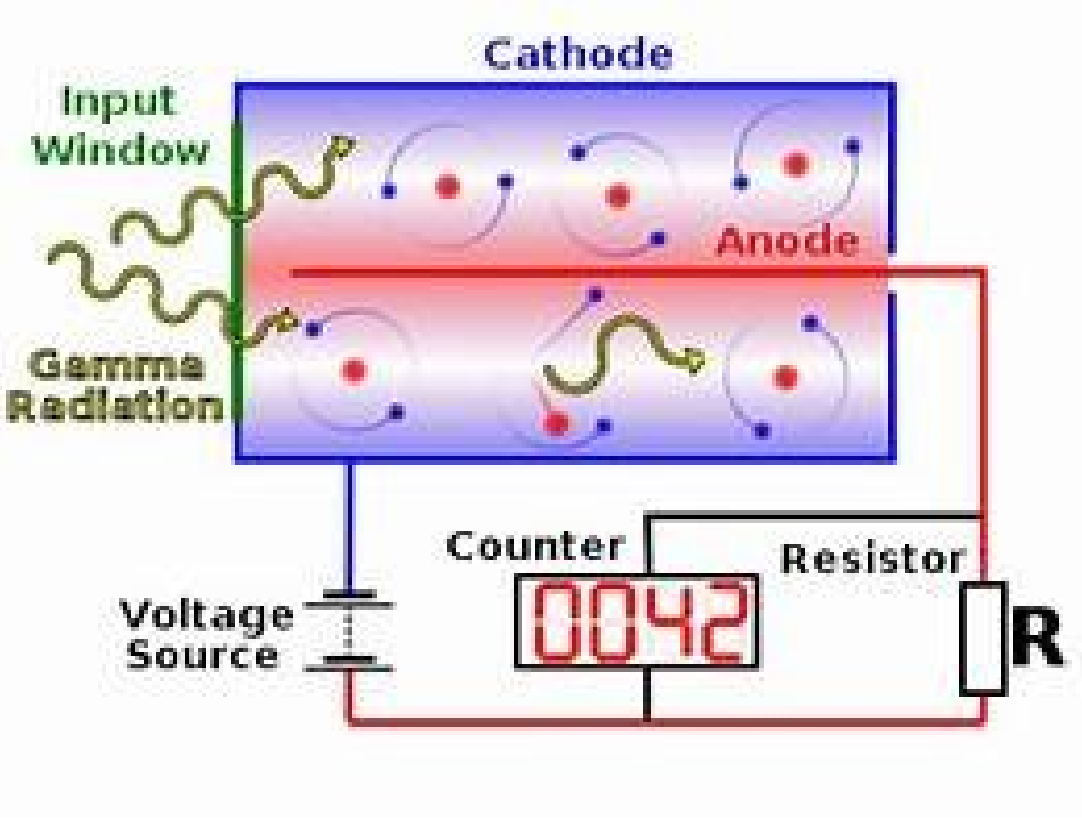
You need to be able to detect the amount of radiation being given off to determine how much radiation you have received or how much you are going to receive especially when you leave your shelter. This knowledge can save your life and the life of your loved ones by telling you when you have reached a harmful or lethal dose. Consider keeping at least one in a Faraday Cage so you can continue to take readings after the bombs have stopped exploding.

Types of Detectors

There are a number of different types of detectors (dosimeters) that you can choose from with different costs. Your detector should be able to detect gamma rays, beta rays, and X-rays since they are the most dangerous you might be exposed too during an explosion. However, X-rays are not continually given off so they do not “hang around” thus not something to be continually worried about. The cheapest and most common way to detect radiation is a instrument that uses a Geiger-Mueller Tube.

Types of Detectors

It is an electronic device and subject to an EMP. You want at least one detector (dosimeter) to be non-electronic because of the EMP. In “Nuclear War Survival Skills” by Cresson H. Kearny the book contains his directions on how to build a homemade Kearny Fallout Meter (KFM) which requires no electricity. You can buy a RADTriage 50 from http://www.amazon.com.



How a Geiger-Mueller Tube works.

Kearny Fallout Meter (KFM). It is a lot smaller than what you might think from the picture.

Units

- curie (becquerel)-amount of activity
- Roentgen (R)-amount of exposure
- rad (gray)-amount of absorbed dose
- rem (sievert)-equivalent dose

A GMC-320 Plus radiation detector can give you R/hr or Sv/hr in which you can look up in a chart to see what the possible consequences to your body will occur.

Amount of Exposure

Roentgen is the unit used to express the amount of gamma radiation exposure an individual receives. It is the cumulative gamma radiation exposure. In other words, if you are exposed to 50 R one hour and 25 R a different hour, you are exposed to 75 R.

Absorbed Dose

Relates the different types of radiation (**α, β, γ**) to the **energy** they impart into a body or materials.

$$1 \text{ Gy} = 1 \text{ J/kg}$$

$$0.01 \text{ rad} = 1 \text{ J/kg}$$

Equivalent Dose

It is a unit of measurement that relates the dose of any radiation to the biological effect of that dose.

Equivalent Dose (H) = Absorbed Dose X radiation weighted factor (w_R)

Different tissues are more or less susceptible to radiation. Your lungs will be more susceptible to radiation then say your skin exposed to the same amount of radiation. So the weighted factor will be larger for lungs then for skin.

Interpretation

You need to be able to relate what units your detector gives to something meaningful. If your detector gives R/hr or Sv/hr what does that mean? Am I going to be sick? Or really sick? Can I leave my shelter or will it kill me? There are different charts in different units that relate the amount of radiation to the risk. We will be going over the risk in the next section.

Electronic Equipment

According to the Oxford Dictionary, "A Dictionary of Physics" a Faraday Cage is:

"an earthed screen made of metal wire that surrounds an electronic device in order to shield it from external electrical fields."

I have my electronic equipment in ammo cans with the devices surrounded by Faraday cloth that I bought at Amazon. Between the devices and the cloth I have a non-conducting material like cotton balls.

Electronic Equipment

Some of the equipment I have protected are hand held CB radios, hand held Ham Radios, Walkies-Talkies, Geiger Counters, a hand held weather station, and AM/FM hand crank radios. I have Faraday bags for a computer, tablet, and phone. I have extra batteries in hard cases as well. What is important during a crisis is communication. With the CB and Ham radios I will be able to talk back to others. They do have limited range though.

Section IV

Our Risks, Biological Effects, and Protection

Our (and their) Nuclear Triad

- **Submarines**-takes about 5 to 15 minutes to reach there targets depending on where they fire from.
- **ICBM's**-takes about 20 to 30 minutes to reach there targets.
- **Bombers**-takes up to two hours to reach there targets.

Where Are They Going To Attack?

- **Primary**-They will probably attack are ICBM sites, Airports (long enough for bombers) and alternates, Major Military Installations, and some Major Cities especially with major industrial sites and ports.
- **Secondary**-They will probably attack more Cities, nuclear reactors, government labs, communication and electrical hubs, and Remaining Military Sites including depots.

Leave the cities! It is your best guess so choose wisely. I would like to be at least 100 miles from any potential target to avoid major bomb effects. You will still have to deal with fallout and wild fires.

How Long Do I Shelter?

Nobody knows for sure!!

- **Rule of thumb**-every 7^n hours where n is a positive whole number, the radioactivity should decrease by 10 percent. However, to have any importance you will need a initial reading when the radiation hits your area. It really is dependent on the number of bombs delivered and size.
- Or wait in your shelter for two weeks.
- Or use your radiation detector to determine when the radiation decreases enough. **This will be the most accurate and safest!**

Protection Of Major Biological Systems

- **Bodies Exterior (skin)**-cover yourself up and keep radioactive dust off your skin. Duck tape the ends of your pants and your shirt so fallout will not get in that way.
- **Respiratory System**-cover your mouth and nose with shirt or handkerchief but it is best to use a P100 mask or NBC gas mask.
- **Digestive System**-clean off the packaging of food of fallout and then you can eat the contents of packaged foods or bottled water. **Filter** water of radioactive particles if from unprotected sources.
- **Thyroid Gland**-take Iodine tablets but will not protect much else but the thyroid.

This is a sign that was used to designate a shelter that could be used as a fallout shelter. However, did not designate that it would protect from other effects of blasts. You might still see on older buildings.

Shelters

- **Bert the turtle says, "Duck and Cover"**- There was a Civil Defense commercial that stated that caught out in the open then get to lowest point or behind something and duck and cover.
- **Basements**-Basements make great shelters since the earth and walls have a tendency to block radiation. They do suggest that you build a room inside the middle of the basement with concrete blocks to get the best protection.

Shelters

- **Using Buildings**-Building marked with a fallout shelter symbol provides some protection in a pinch. They are not usually long term solutions and you may have to leave them to get where there may be food and water and better protection. They say that if you are in a tall building that does survives then staying in the middle of the building and half way up is best. You avoid radiation on the ground and on the top of the building.

Shelters

- **Digging a shelter in your backyard**-There are many floor plans available in books or on the internet for building a shelter in your backyard that should not take a lot of time to build except for a couple of days. You would have to plan for what effects the shelter will need to protect you from your given location.
- **Building an offsite shelter**-Building a shelter offsite where there may not be high concentrations of fallout is another option.

Shelters

If it is engineered properly it can protect you from fallout and looters. It is also useful if you could design it to fit your family needs. This would probably be best just for that reason. However, getting there might be a problem. You might have to go through pockets of high radiation and you may have to walk there if there is no warning due to the EMP.

Note: Every family is different. You have to take into account the cost and the ideal place to place these shelters. The idea is if you can build a shelter before you need it you can stock it with supplies and put the features in it that will make it more comfortable for your entire family. It also gives you an opportunity to build using good materials and not something that is sub-par and in a pinch. You have to be careful about using a shelter that was designated a shelter 50 years ago though. The bombs have gotten bigger and more destructive. So, what worked in the past may not be adequate now. There are many plans on the internet and in books so you can find one that fits for you and your family.

Harmful or Lethal Doses?

- **Less than 200 R**-you have a chance for radiation poisoning.
- **Between 200 R and 800 R**-you are likely to get radiation poisoning and there is a chance for death.
- **Greater than 800 R-**there is a likely-hood of death but even that is not guaranteed.

Note: The estimates are based on no medical intervention. Different sources give different values so these are my ball park figures. 800 R is in-between 6-10 Sv. There is a chart on the next slide that I found on the internet that will you the risks of different levels of exposure that are more detailed. My NukAlert gives R/hr.

Chest X-ray	0.1 mSv
Average background exposure in one year	3 mSv
Abdominal X-ray	4 mSv
Living on the Colorado Plateau for one year	4.5 mSv
Typical yearly dose for a uranium miner	5-10 mSv
Full-body CT scan	10 mSv
Lowest dose for any statistical risk of cancer	50 mSv
Mild radiation sickness (headache, risk of infection)	0.5-1 Sv
Light radiation poisoning (mild to moderate nausea, fatigue, 10% risk of death after 30 days)	1-2 Sv
Severe radiation poisoning (vomiting, hair loss, permanent sterility, 35% risk of death after 30 days)	2-3 Sv
Severe radiation poisoning (bleeding in mouth and under skin, 50% risk of death after 30 days)	3-4 Sv
Acute radiation poisoning (60% fatality risk after 30 days)	4-6 Sv
Acute radiation poisoning (bone marrow destroyed, nearly 100% fatality after 14 days)	6-10 Sv
Acute radiation poisoning (symptoms appear within 30 minutes, massive diarrhea, internal bleeding, delirium, coma)	10-50 Sv
Coma in seconds or minutes, death within hours	**50-80 Sv**
Instant death*	**>80 Sv**

1 Sv = 1 J/kg = 1 joule of radiation energy into 1 kg of tissue ~ 5.5% chance of cancer.

* Actually, an instant death would be ideal. There have been a couple of recorded cases where people have been exposed to levels over 100 Sv and lived for hours or days. **1 Sv = 100 rem.**

Symptoms

The symptoms are dependent on your current health before the exposure and dependent on the amount of exposure. Also, you can get sick, then well, and then sick again (latent phase) due to the damage to the bone marrow and other factors. So try to and be prepared for that second bout and be patient of others. This type of event is obviously going to take a toll on you psychologically as well as physically. The stress is going to effect everybody differently so things can get unhinged. Given that death is not guaranteed do not jump to conclusions and euthanasia anybody.

Early Radiation Sickness

- Nausea
- Vomiting
- Diarrhea
- Anorexia
- Burns and skin irritation
- Hair Loss

Latent Radiation Sickness

- Malaise
- Fatigue
- Drowsiness
- Weight Loss
- Fever
- Abdominal pain

Latent Radiation Sickness

- Insomnia
- Restlessness
- Blisters
- Spontaneous Abortion
- Possible Death

Severe Radiation Sickness

- Excitability
- Lack of Coordination
- Breathing Difficulty
- Occasional Periods of Disorientation
- Death

Timetable For Symptoms

It is hard to determine the exact time of symptoms because everybody is different. Your body is great about repairing itself but if the dose is high enough it will kill the cells in your bone marrow that produce your RBC's, WBC's, and platelets

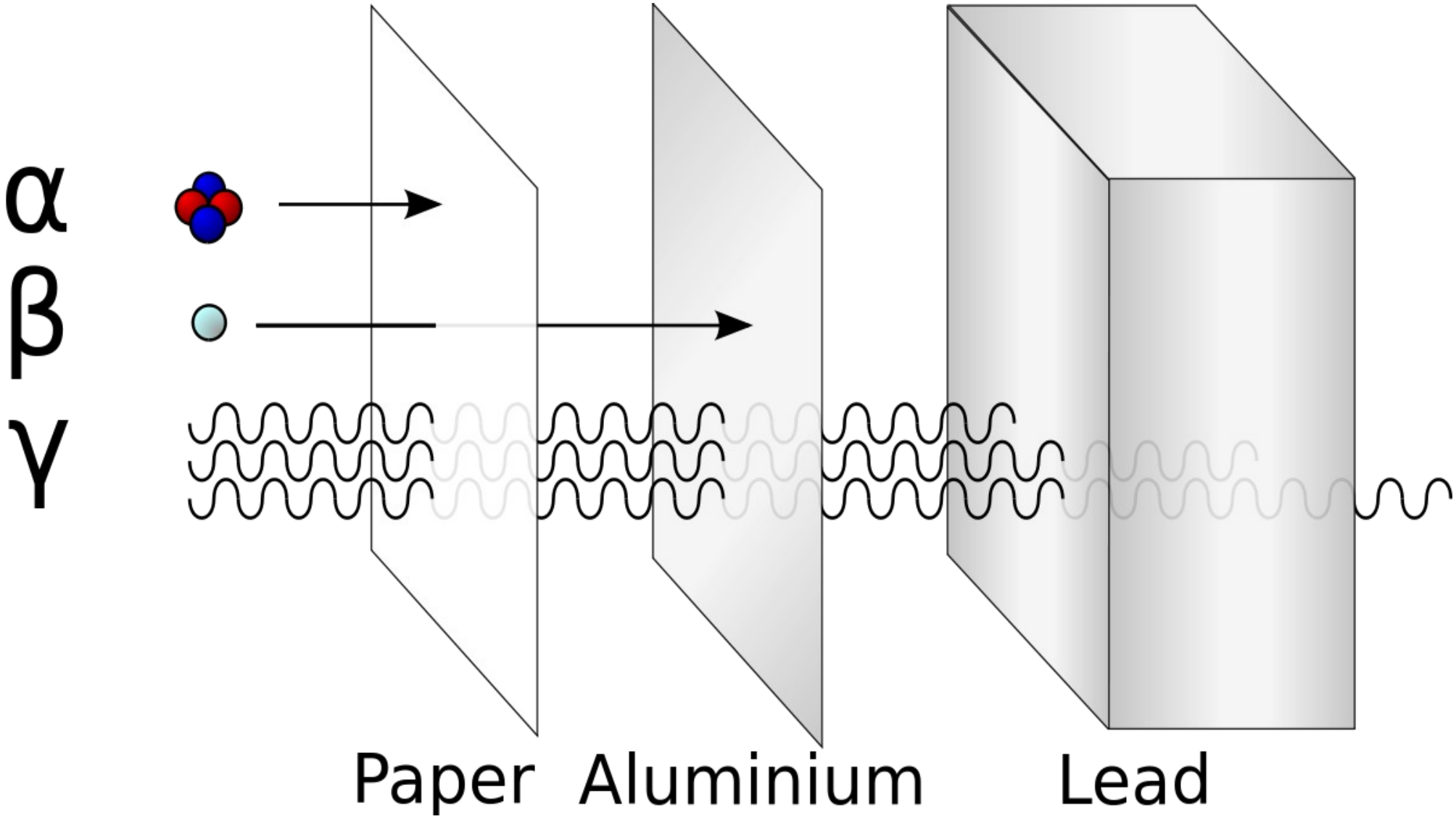
Timetable For Symptoms

The reduction in platelets causes bleeding. The reduction in WBC's means you will susceptible to illnesses. The reduction in RBC's will cause anemia and breathing problems because less RBC's means less oxygen getting to your cells.

Science of Protection

- **Time**-limit the duration of exposure.
- **Distance**-keep the distance from the source of radiation as far away as possible.
- **Shielding**-put as much material between you and the source of radiation. If not in a shelter you can lay a door against a wall and put anything you find against it (beds, doors, etc.).

Note: If close enough to an explosion to be exposed to the Thermal effects keep a bucket of sand and other fire fighting equipment in your shelter to fight the fires afterward.



The penetration power of different radiations.

Time

The amount of radioactivity will decrease with time, so, the **longer** you can spend in your shelter the **better.** The smaller your shelter is, the harder it will be to stay in your shelter. So, having games or books will help you pass the time.

Distance

The farther away from the blast you are, the more likely the lesser amount of fallout will be in your area. Remember, the heavier and more radioactive fallout will fall closer to the blast, but you still **do not want to be downwind of the blast**. That means the wind is blowing the radiation towards you. The closer you are to the blast, the more you have to worry about over-pressure, blast wave, and thermal radiation. So, you have to plan your shelter accordingly.

Shielding

Generally speaking, the thicker and denser the material the better the protection. Put as much material as you can between you and the radiation. You can download or find floor plans to build shelters. Tornado shelters are better than nothing and since I live where we do not have basements, will work in a pinch. Remember, it is to late after a war begins to start building a shelter.

Shielding

Materials Used For Making Shelters

- Wood
- Aluminum
- Earth
- Concrete
- Steel

Diet

You should keep a large bottle of vitamins in your kit. Take them when you eat whatever it is you have to eat to prevent stomach upset. Vitamins can help prevent things like scurvy, etc. Make sure your vitamins also have iron for the production of RBC's. Men's vitamins do not usually have iron so buy a separate supplement if necessary. If you are vomiting and have diarrhea you will be loosing your electrolytes more quickly so the electrolytes need to be replaced. So, drink plenty of fluids that contain no alcohol and preferably electrolytes like Gatorade, Power Aid, etc.

Diet

You will also need to grow some food for yourself. You will need non-hybrid seeds. I keep mine in the freezer because they last a few years that way. Otherwise, rotate them annually. You should grow them inside to avoid contamination with fallout. Remember to use filtered water when watering them or they will uptake the radiation with the water and nutrients.

Diet

When you come out of the shelter, if you have a greenhouse, or you can build one, that will work best. That will help you keep radioactive rain off your food. Anti-oxidant vegetables are very good to help fight cancer. During your confinement you could read a book on gardening to help pass the time if you do not know how to garden. Growing food, before requiring it, is best so you can get the experience. So, keep that in mind as well.

Medicinal Plants and Herbs

Since it may be difficult to get medicine for a while I would suggest that you have some knowledge/books about medicinal plants and herbs. It may be to dangerous to go to the cities where the pharmacies would be because of radiation or gangs. Prescription medicine is better than the plants or herbs so you have to weigh the risks.

Medicinal Plants and Herbs

I would try the plants or herbs out before you rely on them by buying them now and trying them. This gives you a chance to make sure your not allergic to them and that they will work for you. I have also looked mine up on at least two sources to make sure the information is at least the same. When you think you have found a good herb or plant then you have to order the

Medicinal Plants and Herbs

seeds by genius/species and once again make sure they are not hybrids. Know what you are growing and eating. Another reason for learning about gardening.

Disease

Antibiotics would be nice to have in your kit but not always possible. Medicinal plants and herbs may not always work. The best way to keep disease down is to keep up with your sanitation. You can keep your waste in trash bags until full and then throw them outside your shelter. You should bury the bags once it is safe to go outside.

Disease

Also, you may have to use some of your precious water to clean yourself. It can help you from getting infections. I have baby wipes in my kit to help keep me clean for a little while and bars of soap for later in my kit. You should remember that outdoor water sources may contain a lot of radioactivity so be careful where you choose to take a bath.

Section V

Summary

Nuclear war would not be isolated. Radiation would cover the globe. It would cause hardships for everyone living on the planet. Even if it started off between two adversaries it could lead others to get involved. For instance, if any country attacks a NATO country then the other NATO counties have agreed that that is an attack on them. Thus, leading them into the battle. The countries that have nuclear weapons also would probably use them or lose them. There is also a large number of nuclear weapons between the nuclear

powers. Enough that would probably make this planet uninhabitable. Mutual Assured Destruction or “MAD” is not a guarantee to keep the nuclear weapons from being launched because the threat from terrorist is very real and would cause nuclear retaliation. Also, there has been a few times due to one reason or another that they came very close to shooting them off by accident. Even if there is only a few that were launched the pain and suffering is unimaginable. It causes permanent physical and emotional wounds and its effects last for many generations. So that one act of anger could have lasting

effects on mankind. It is a scary topic and is depressing just thinking about it. However, it is a possibility and should not be dismissed. One good thing is if you are prepared for a nuclear exchange then you are probably prepared for many other types of earth shattering events. Including a nuclear meltdown at a nuclear power plant. The radiation is basically the same (some different isotopes) but the protection is the same. The main thing to be worry about is radioactive steam being release. So take heart. Be Prepared.

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Glossary

A

- absorbed dose-the amount of radiation exposed and thereby absorbed by a person or by a particular body system. The amount of radiation that is absorbed does depend on whether the whole body is irradiated or only certain body systems are exposed. Certain body systems are more susceptible to radiation than by others. The unit of absorbed dose is the gray. It is defined as 1 Gy = 1 J/kg. Where J is joule and kg is kilogram. The original unit was defined as the rad but I will try to use SI which is the gray.

- acute radiation sickness-when a person is exposed to a lot of radiation in a short amount of time (less than 24 hours) the body can not cope with that much radiation and the person gets very sick and is likely to perish in a short amount of time but not without suffering a great deal. Radiation is fatal for 95% of the population for dosages of >600 R. You can find out more information about acute radiation on CDC's Acute Radiation Page.

- air burst-when the nuclear bomb goes off at an altitude less than 100,000 feet but high enough that the fireball does not touch the ground.

- ALARA-it stands for as low as reasonable achievable. During radiation treatment of cancer you will only expose the person to the lowest amount of radiation that can achieve your goal of curing the person of cancer. Any more than that is dangerous and is unconscionable. You want to cure the patient not kill them or cause them to have cancer in the future.

Glossary

- alpha radiation-the particle that is given off is made up of a nucleus of a helium atom and is considered alpha radiation. When alpha radiation is given off the particle does not penetrate very far. A piece of paper or air can stop the particle. It is most dangerous when it is ingested or breathed in. For clarity it is 2 protons and 2 neutrons.

- atomic bomb-an atomic bomb is a fission bomb that uses Uranium or Plutonium as apposed to a fusion bomb. When a atomic bomb goes off it has the following types of killing characteristics: radiation, thermal energy, very high winds, and crushing pressure. It is a weapon of terror and is the stuff of nightmares. It is also a weapon that can kill all life on this planet if used.

- atoms-in simple terms it is made up of three small particles: electrons, protons, and neutrons. The number of protons determines what the atom is called. For instance Carbon is made up of 6 protons and is therefore the sixth element on the Periodic Table of Elements. An element has more sub-particles but for this discussion we will limit it to the three.

B

- beta radiation--is a electron. It is higher in energy than alpha radiation but has less energy than gamma radiation. It can be stopped with a little shielding like wood but will not necessarily be stopped by paper or clothes like alpha radiation.

- blast wave-there is a wave front of winds and pressure that has the blast as its center. That wave front is called the blast wave. At first it expands from the blast and eventual reverses and goes toward the bombs center as the air rises. Like a ripple caused by a pebble being thrown into a still pond. It goes out like a the ripple but unlike the ripple it reverses and it is sucked backward due to heat and differing pressures. See thermal wave as the other type of energy given off by the nuclear bomb.

Glossary

C

- cancer-within about 2 years you need to keep checking for leukemia's and after about 10 years you should check for other cancers caused by the radiation from a nuclear blast. Your cells are very good at protecting its DNA and RNA but with large doses of radiation it exceeds the cells ability to protect the cell thus causing cell death or cancer.

- centrifuges-they are very high speed centrifuges used to concentrate the uranium ore into uranium-235. The centrifuges need to be expertly engineered so they do not become unbalanced and just fly apart. There are hundreds of centrifuges used in the concentration of the uranium ore to weapons grade uranium. There is very little of the uranium-235 mixed in the uranium ore, less than 1%. Almost all of it is uranium-238.

D

- deuterium-it is hydrogen with one proton and one neutron. Sometimes called heavy water.

- dosimeter-it is a device that can detect different types of radiation and X-Rays and help you determine how much radiation and X-Rays you have been exposed too. It does not necessarily need to be electronic but can be a device or film when it is exposed to radiation and X-Rays it changes and after a certain amount of time is taken to be "read". This method is often used by X-Ray techs. I have a credit card sized card that when it is exposed turns different colors depending on the amount of radiation and X-Rays it is exposed to and it lets me know how much radiation and X-rays I am exposed too. The usual dosimeter measures gamma and beta radiation and X-Rays but does not detect alpha radiation. A special attachment or a different device needs to be used to detect alpha radiation. See also Gieger counter.

Glossary

E

- early radiation sickness-when a person is exposed to a dose of radiation they can have radiation sickness. There are many factors that determine how sick a person gets like how much radiation they were exposed to, how long they were exposed, and how far they were from the source of radiation. Radiation sickness comes and goes and comes back again. I designate early radiation sickness as the first bout of illness before the symptoms seem to go away. It is sometimes hard to distinguish between a dose that just makes you sick and is not fatal from a fatal dose. The symptoms are: nausea and vomiting, hair falling out, sunburn and/or blisters, some bleeding in urine and feces, spontaneous abortion, headaches, fever, infections, and some others. The symptoms seem to go away as your body tries to repair itself. Then as the bone marrow dies after a period of time the symptoms come back. As a treatment for cancer like leukemia, radiation is used to kill the cancer cells in the bone marrow and allow the normal cells to take over the bone marrow. So if you do not get enough of a dose to kill your bone marrow totally than given enough time the bone marrow will recover. However, risks of infection and bleeding may cause the person to perish before this can be achieved. See also acute radiation sickness.

- electromagnetic pulse-when a nuclear bomb explodes it causes a electromagnetic pulse that burns out transistors which are in computers, radios, and other electronic devices making them inoperable. The area this occurs depends on a number of factors. If a nuclear bomb goes off at an altitude greater than 100,000 feet it is considered a high altitude burst. This can effect large areas. It is theorized that it would not take to many high altitude bursts to completely put the United States back to the pre-industrial era.

- electromagnetic waves-a photon of different energies gives us the electromagnetic spectrum. Different types of energy fall on this electromagnetic spectrum. For instance visible light falls on this spectrum along with radio waves, ultraviolet light, infrared light, and others. Gamma radiation is highly energetic and falls on one end of the spectrum. Hard and Soft X-rays fall just below gamma radiation. That is why gamma radiation is so dangerous. It is highly energized. Soft X-rays are not as highly energized but still high enough in energy to cause damage to the human body. Given that gamma radiation and soft x-rays are photons of electromagnetic energy and is given off during a nuclear explosion is why this is brought up. This is a over simplification of this concept but it is important to understanding what gamma radiation and x-rays are. You can view a electromagnetic spectrum of electromagnetic waves at NASA.

Glossary

- electrons-in an atom the electrons orbit a nucleus. Since the electron orbits a nucleus it is "exposed" enough that it can be knocked away from the atom giving us beta radiation. It has mass and has a negative electric charge even if the mass is very small.

- equivalent dose-different parts of the body react to radiation to more or less degrees. So equivalent dose is given by an absorbed dose multiplied by a radiation weight factor for that part of the body or organ: equivalent dose, H (Sv) = absorbed dose (Gy) X WR. Sv is called a sievert. It gives a value that will tell you if that particular organ or body part is at risk for cancer or genetic damage. It is easier to use this value for treatment since the radiation will be pointed toward a certain area or organ. A full body exposure would be harder to use this value since multiple organs will be given a dose.

  F

- fallout-it is the material that is vaporized and sucked up into the air by the nuclear blast and becomes radioactive. Eventually over time the material comes back down in what is called fallout. Even if you are not close to the fireball you can still get a dose of radioactivity from the fallout. It follows the wind patterns so if you are downwind move away from the fallout as quickly as you can to protect yourself from the deadly fallout. Some will come down in the rain so if the rain is "black" or has material in it the rain probably contains a lot of fallout and you should get to shelter as quickly as possible for protection. When you come out of your shelter be very wary of bodies of water since rain has a tendency to wash the radioactive material to bodies of water. Boiling or adding water purification will not remove the radioactive particles. You need to filter it. I have extra cotton fill and activated charcoal for fish tanks to accomplish this in an emergency such as this plus the water purification pills. I have been told that a well packaged food will not become radioactive. So you can eat the packaged food. I personal would use my gieger counter to test it before consumption and make sure a can is not bloated or the food does not smell to bad when opened. Also, you will need to start to grow food using non-radioactive dirt and water. So seeds are a necessary commodity.

Glossary

- faraday cage-if you enclose a electronic device in a conductive metal container or material it can help negate the electromagnetic pulse and protect the electronic device from being fried. You can purchase faraday cage bags or material to wrap a device in from the internet or you can make your own by using a conductive metal container. Some people say using a metal barrel with sand in it so you can put the device in the middle is a great way to protect electronic equipment. There is no guaranty that the item will be protected but it couldn't hurt. The most important things to protect would be a radio and a radiation detector so you could possibly get updates but there may not be any radio stations left after a nuclear exchange. The problem will probably be batteries. They may not last long enough for the military to start broadcasting after a while. Remember the experiment you may have done in physics or chemistry where you used potatoes to create a battery or you can buy a radio that uses solar power or a hand crank to create electricity. A radiation detector can help you decide when you can go outside again. This is sometimes called hardening the device.

- firestorm-when a fire or multiple fire creates its own weather patterns. During World War II a firestorm was created by conventional bombs in Dresden, Germany. A firestorm can create a fire tornado which compounds the effects of the fire. When a nuclear weapon goes off its thermal energy creates an expansion of heat outward but since heat rises there is vacuum created and there is a rush of air back toward the vacuum causing a mushroom cloud that rises. A nuclear explosion used to be discussed in terms of a firestorm but I have not heard it used in this sense in a long time.

Glossary

- fission-fission is when a neutron is given off from an isotope and collides with the nucleus of the isotope next to it to give off two to three more neutrons. If the collisions produce enough collisions with other isotopes creating a self sustainable reaction then it reaches super criticality and a nuclear explosion occurs. There has to be enough of the collisions to kept the collisions going or the isotope is said to be sub-critical. Remember that the nucleus is very small so that is why a implosion is used to create the nuclear explosion. It helps to overcome the repulsive nuclear forces and bring the atoms closer together so the odds of neutrons bombarding the other nucleus' is increased. That is why the gun type nuclear bomb is less efficient and probably not likely be used anymore. There is an interesting demonstration of fission at the JavaLab.

- fission products-when radioactive Uranium or Plutonium gives off radiation the material that is left can and is often radioactive itself. That is why you have to be careful of the products of radioactive materials that give off radiation as well as the original bomb material you start off with. Some of the products to watch out for are radioactive Strontium, Cesium, Iodine, etc. after a nuclear explosion. These products have different half lives as well and some of them are very bad for you even if they were not radioactive.

- flash blindness-if you are looking at a nuclear flash it is so bright that it can blind you. The blindness can be permanent or be temporary so it is best not to be looking at the flash.

- fusion-is what makes a atomic bomb into a thermonuclear bomb or H-Bomb. The reason is the fission reaction is used to create a fusion reaction in addition to the fission reaction. The sun uses the fusion of hydrogen to helium to keep it going. A thermonuclear bomb uses the fusion method like hydrogen to helium or another material is used instead of hydrogen like lithium. Thus the name H-Bomb for hydrogen fusion. Deuterium and tritium are usually used instead of hydrogen even though they are different forms of hydrogen. The fusion increases the yield of the bomb making it "stronger" and more deadly.

Glossary

G

- gamma radiation-it is the high energy electromagnetic radiation given off by isotopes. It can cause a great amount of damage to the body due to its ability to penetrate deep into the body and through it. Gamma radiation damages the cells of the body and the DNA in the cells causing cell death or cancer. The best defense is to limit the amount of exposure to gamma radiation to ALARA or none depending on how it is used. Remember it is used to treat patients with cancer as well as used for weapons.

- Geiger counter-is a device that can measure radiation. You might of seen the yellow devices that Civil Defense used to detect radiation in the day. Now they have different looking devices that can detect different types of radiation and X-Rays. To detect alpha radiation you either need a specific device to detect it or have a special attachment that connects to your device. They usually give you CPM, Sieverts, or Roentgens. Remember you will probably want to print a unit to symptom table so you can interpret what symptoms you are going to have given the amount of Sieverts or Roentgens you receive. You may want to add a dosimeter that is not electronic to your supplies given that the Geiger counter may be knocked out by a EMP pulse given the computer part of the device. See dosimeter.

- ground zero-it is the ground point right underneath the nuclear blast. When you talk about the characteristics of the nuclear explosion going out to a mile you are measuring the distance from ground zero to a mile out.

Glossary

H

- half life-a radioactive atom does not give off radiation linearly. It gives off half of the radiation for a specific atom for the atoms half life. Lets say we have a substance made up of I-131. I-131 has a half life of 8 days. So after 8 days there will only be half of the radioactivity than originally. After 16 days it will be half that meaning that it will have a quarter of the radioactivity then what we started off with and after 8 more days it will be half that or decreased 1/16th of what it was. That is what is meant by half life. Each radioactive atom has its own half life. Plutonium-239 for instance has a half life of about 24,000 years so you do not want that lying around. Uranium has a half life of about 7 x 108 years or 700 million years.

- high altitude burst-it is a nuclear bomb that goes off above 100,000 feet. You certainly do not get the heat (thermal energy), winds and pressure, and the amount of radiation of lower altitude burst. You would do this to cause a electromagnetic wave that is spread out a lot more than a lower burst and covers a greater area. This is a significant problem to all the electronic equipment that we use today. That alone could put us back to the pre-industrial age.

- hydrogen bomb-a hydrogen or thermonuclear bomb uses fusion as well as fission to create a larger more damaging nuclear explosion than just a fission bomb or atomic bomb alone.

Glossary

I

- implosion-an inward rather than an outward explosion. It is used more often than a gun like type of nuclear bomb. One half of the nuclear material is aimed at the other half and blown together to create the nuclear explosion. It is inefficient and wasteful way to create a nuclear explosion. If they direct all the force inward it creates a more efficient and cleaner nuclear explosion. It is a battle between keeping the radioactive material close enough to keep it fissioning and the outward forces of blowing it apart.

- initial radiation-it is all the gamma radiation and X-Rays that is created during the nuclear explosion as compared to the fallout.

- ionizing radiation-is the high energy radiation that can knock a electron off a atom thus creating ions. The ions can cause damage to a cell thus making it dangerous to the human body.

- isotopes-a isotope is atom that has more neutrons than protons in the nucleus. When the neutrons exit the nucleus it gives off or causes energy in the form of gamma, beta, and alpha radiation. One neutron can cause two to three neutrons of the atoms next to it to give off there neutrons. When a cascade is created using isotopes of Uranium or Plutonium to keep the fissioning going you can have a self sustaining nuclear reaction causing a nuclear explosion. The trick is to keep them just close enough to the self sustaining reaction without reaching super criticality until the desired time you want the nuclear explosion to go off.

Glossary

K

- kiloton-a nuclear explosion is compared to the chemical explosion of TNT. One kiloton is equal to 1000 TONS of TNT which is a huge amount of TNT. It would be very difficult to deliver 1000 tons of TNT to one spot to deliver a one kiloton explosion without being discovered.

L

- latent radiation sickness-if you are exposed to an amount of radiation that does not outright kill you then you can go through radiation sickness and then feel better for a little while and then BAM. You get sick again. This second bout is called latent radiation sickness. That is one of the cruel things about radiation. You think you have gone through the worst of it and then you get sick again and possibly die the second time around. The latent radiation sickness is caused by bone marrow death. The White and Red Cells along with Platelets are grown in the bone marrow. So if you have those cells die then you are susceptible to infections, bleeding, other symptoms.

Glossary

M

- megaton-a megaton is a 1000 kilotons of TNT and a kiloton is 1000 TONS of TNT. So you are looking at 1,000,000 TONS of TNT. In a nuclear explosion that much energy is given off in a split second.

- mirror-it is used to keep the neutrons confined in the implosion so the fissionable material in the nuclear bomb is used up in the reaction. It makes the explosion more efficient and "stronger". Remember it is a battle between blowing apart and the all the isotope fissioning creating the explosion.

- mushroom cloud-when a nuclear explosion occurs a pressure wave is created that goes outward. After the pressure wave reaches it's greatest distance, the air starts to fill back due to the displaced air the explosion caused (pressure gradient) and the heat starts to rise in the air. This causes a mushroom like cloud filled with radioactive debris that will fall back down to earth as fallout. If you see a large chemical explosion you see the same thing but without the radioactive debris and fallout. I saw a oil plant explode once and saw the upward explosive ball that looked like a mushroom and it deposited a oily substance on our house miles away from the actual explosion. People died in that explosion. I am talking about the Texas City Refinery (TCR) explosion around 1980.

Glossary

N

- neutron-is one of the three fundamental elements that we have discussed. It has mass but does not have a electrical charge. When the neutrons outnumber the protons in the nucleus of an atom it is called an isotope. A self sustaining neutron generation of neutrons is what creates a nuclear explosion.

- neutron initiator-it is in the center of a nuclear bomb but it can be external to it as well using another method. It is used to create a burst of neutrons to help start the self sustaining neutron generation creating a nuclear explosion. Beryllium and polonium are brought together to create a burst of neutrons in the center of the bomb sometimes called the pit.

- non-ionizing radiation-it is the lower energy radiation that does not knock off electrons from a atom. It makes it less dangerous to the human body than ionizing radiation.

- nuclear winter-some people believe that if there is a major exchange of nuclear weapons that the amount of debris thrown into the atmosphere will block off sunlight thus causing the temperatures to go down. I think this will be the case plus other horrible things will happen to the environment. Nuclear war is not only bad for humans but also for the animals and the environment.

- nucleus-it is the center of the atom that contains the neutrons and protons. It is very small and in some cases considered difficult to get at.

Glossary

O

- overpressure-it is the pressure increase caused by the nuclear explosion. It is measured in PSI in the US. It is like scuba diving. The farther you go down into the ocean the higher the pressure is and like in the movies it crushes things like the human body and submarines. See blast wave.

P

- periodic table of elements- Periodic Table of Elements at https://artsci.tamu.edu/chemistry/academics/first-year-chemistry/index.html
- plutonium-plutonium-239 is used in making a nuclear bomb. It has a half life of about 24,110 years and is usually produced in a nuclear reactor.
- proton-protons are positively charged and have mass. The number of protons is what determines what a element is called.

Glossary

R

- radiation-is unseen and you can not taste it and you can not feel it while you are being exposed. That is one of the reasons why it is so dangerous. You can be exposed to a lethal dose and not even know it until it is to late. There are three different types of radioactive radiation caused by isotopes called alpha, beta, and gamma radiation. Alpha radiation is the nucleus of a helium atom. One way Beta radiation is created is that the electron is ripped from a atom that has been collided with a neutron. Gamma radiation is the electromagnetic energy that is given off by collisions of neutrons with the nucleus of the isotope atom next to it. X-rays are also given off during a nuclear explosion. The radiation given off during the nuclear explosion causes the vaporized debris to become radioactive and come back down as fallout. Radiation is also used for peaceful purposes such as nuclear energy and is used to kill cancer cells.

- radiation detector-there are various ways to detect radiation. There are even ways to determine what isotopes are causing the radiation. However, the most common and cheapest way to detect radiation in a radiation detector is a Geiger-Muller tube. It is used to detect the beta and gamma radiation and X-rays given off by a nuclear bomb and fallout. You do not really need to know which isotope is giving off the radiation. Just how much is being given off so you can determine the dosage you are receiving and which areas are clean. The other methods are usually to cumbersome and expensive and usually found at research and government facilities. You can use the Geiger counter to determine how much radiation is being given off so you can keep the total dose below 70 R. You will get a little sick but most people will recover. If you receive a 200 R dose 5% of the population will perish. 600 R is given as the dose that 95% of the population will perish. These are used for people with little to no treatment. Everybody is different and can tolerate more or less radiation. It is best to go with the less amount to make sure you are not likely to die. Survival is the goal here.

Glossary

- radiation protection-the principles of radiation protection are time, distance, and shielding. Time is not necessarily on your side. One of the problems depends on the isotope and it's half life. If it is 24,000 years you are looking at a long time for the radiation to decrease. During fission there are going to be some other isotopes that are produced as byproducts and that do not have such long half lives and therefore the radiation will decrease over time. So time is going to help but how much depends on other factors like how many bombs went off and how big they were and where were you in relation to explosions? Also, since you may be in a shelter for a while you will need food and water. If your shelter does not have food and water then like I said time is not on your side. You may have to leave to get somewhere where you are more protected or you may have to find access to food and water. The distance is going to help a lot. If you are not at or near ground zero and your not downwind of the fallout you will be in good shape. So get as far as you can from ground zero and try to stay away from the fallout. Knowing wind patterns for your area can be very helpful as well. I have a hand held device that will tell me the wind direction, temperature, atmospheric pressure, plus other parameters. Shielding is probably your best bet. Before the fallout reaches you get to a good shelter if you can. Put as much distance as you can from the exterior of the shelter (for distance) and the more thickness of the walls the better. The type of shielding is important as well. Different barriers will provide different protection. Steel would be best but how many buildings are made out of adequate steal or metal? I am not talking about aluminum siding. That will not provide you any protection. A steel ship might do a good job but that will probably be at a port and that will probably be hit with a nuclear bomb. Concrete is pretty dense and depending on the thickness it can provide you with good protection. It is certainly a cheaper building material than steel. Dirt provides some protection but more is needed between you and the radiation than concrete. The deeper you dig into the ground for the shelter the better and the more dirt you can put on top of the shelter the better as well since it will provide more shielding for you. Make sure air can get into your shelter so that you will not asphyxiate. It should be noted that if you have the money and the time you can build a decent shelter before any of this happens. The closer to you the better since you will probably need to get away quickly to lessen the exposure to radiation. If you are planning to drive to your shelter remember the electromagnetic pulse will probably knock out your vehicle and you will probably be walking. That also means that you may have to go through fallout as well which will give you a dose of radiation. People are dangerous when scared so that will be a concern as well. Also, get a Geiger counter. You can use it to determine if you are in good spot and whether or not you are going to get a fatal dose of radiation if you stay at that particular shelter.

Glossary

Radiation is cumulative. If you are being exposed to 25 R per hour than in three hours you will be exposed to 75 R and that should be the limit for all emergency personnel and if the background radiation is still at a high rate then the limit should be lowered. You want to keep it low enough so that a person, even emergency personnel, will not reach a fatal dosage. After a few more hours at that exposure rate it will become fatal pretty quickly. One thing to remember is that you need to keep small children from walking on there own. The reason being is that a small person is closer to the ground and thus there vital organs are closer to the ground where the fallout is and will receive a higher dose to the vital organs than a normal adult. Animals like a dog would get a higher dose to there vital organs than a normal adult as well. You can plan and plan but when those bombs start flying then everything is going to be your best judgment you and must rely on yourself. So being informed is a very good strategy.

- radiation sickness-radiation dosages can cause a number of symptoms and make you very sick. A dosage of <200 R usually is not fatal. It can cause the following symptoms: Nausea and vomiting, Diarrhea, Headache, Fever, Dizziness and disorientation, Weakness and fatigue, Hair loss, Bloody vomit and stools, Infections, Spontaneous abortions, Sun Burn and possibly blisters, and Low blood pressure. Remember there is a latent phase where you may not feel bad and then the symptoms come back. Some of these symptoms are in the late phase due to the bone marrow being suppressed or killed. That is where the white cells, red cells, and platelets are produced. The white cells prevent infections while the red cells carry oxygen to the body and the platelets keep you from bleeding to death. A dose of 200-600 R increase the risk of fatality and a dose of >600 R are likely to cause fatality and a great amount of misery. When you get a dose of >600 your mental acuity is decreased. Confusion, Dizziness, and disorientation with death not long afterward. The symptoms of someone that will not die and someone who has a fatal dose overlap so you have to be careful in your determination of there status. You can go to the CDC radiation thermometer to asses risks from a particular dose: CDC Thermometer. I have a graphic on my phone and a poster on my wall that has the dosage versus risks. I also have it in books and reference materials. Since I carry a card on me at all times that will give me the ball park dosage I receive I will know at least if I am going to survive. I also carry a NukAlert as well.

Glossary

Table 1-1. Levels of sickness and probable conditions of most people after brief whole-body exposure to gamma radiation

Exposure Range (roentgens)	Response	Probable condition of majority during emergency		Probable death rate during emergency	Comments
		Medical care required	Able to work		
0-50R	No symptoms	No	Yes	0	
50-200R	Radiation sickness, Level I	No	Yes	Less than 5 percent	Deaths will occur in 60 or more days
200-450R	Radiation sickness, Level II	Yes	No[a]	Less than 50 percent	Deaths will occur within 30-60 days
450-600R	Radiation sickness, Level III	Yes	No[a]	More than 50 percent	Deaths will occur in about one month
More than 600R	Radiation sickness, Levels IV & V	Yes	No	100 percent	Deaths will occur in two weeks or less

[a] Except during illness-free latent period.

Glossary

- residual radiation-it is the amount of radioactive materials that are left after the initial burst from the fission. Most of this I would consider would come back down as fallout. Do not forget the radioactive material at ground zero as well. You want to stay clear of ground zero due to the heavy radioactivity and fires from the thermal energy. I consider there to be two types of residual radiation. One is the Uranium or Plutonium of the bomb material that did not fission and the material that becomes radioactive due to neutrons bombarding it and making it radioactive. I think somebody called this neutrification. An example of this I read about was that the coral that was vaporized and became radioactive and came down as fallout on a Japanese fishing boat and contaminating it.

- Roentgen (R)-the roentgen is 2.58 X 10^{-4} C/kg where C is Coulombs and kg is kilogram. It is really not used much today but some graphics that show radiation symptoms to R are still around. It is used in a lot of the documentation that I have read over the years (1950's-). So I use it out of habit. See Sieverts. It is used today instead of R.

  S

- 7 to 10 rule of thumb-the seven ten rule of thumb is that for every 7^n hours ,where n is a whole number, the initial radiation will decrease by 10% You can make a graph where the x-axis is 7^n hours and the y-axis is the radiation in R/hr. If you start off with 1000 R/hr then you get the following (7,100), (49, 10), (343, 1), (2401, 0.1), (16807, 0.01). A couple things you should be aware of is that this is a ballpark figure and it is not exact. If the initial radiation is not 1000 R/hr then you need to make adjustments to the actual readings. Remember also that you need to take the highest initial radiation that is falling. If the fallout continues to increase then you need to wait until it settles down to a steady rate. It might take awhile for the fallout to reach you and start falling in your area so wait until fallout falls and settles down. Also you need a geiger counter to take the initial radiation reading and if you have a geiger counter then that is more accurate to determine the radiation level anyway. If you have nothing to take a radiation level then they suggest to stay in your shelter for at least two weeks if you are in a safe area.

Glossary

- severe radiation sickness-mimics regular radiation sickness at first but after a short time you experience severe mental and psychological problems and leads to death pretty quickly. This occurs when you receive a large dosage of radiation of say >600 R. When you get a high dosage of radiation you can get very sick but if you minimal treat the symptoms of the person they could survive. Everybody is different so the data is for risk and not set in granite. See acute radiation sickness and also treatment.

- shadow people-the thermal energy produces a lot of heat and light. Because of this, the body is vaporized and since the body blocks some of this light a shadow is produced behind the person. These shadows are called shadow people because of the shadow of a person is left behind.

- shelters-see radiation protection.

- shielding-see radiation protection

- Sieverts (Sv)-1 Sv = 1 joule/kg where kg is kilogram of body tissue. "The sievert represents the equivalent biological effect of the deposit of a joule of radiation energy in a kilogram of human tissue." From Sievert on Wikipedia: Sievert.

Glossary

- super criticality-during fission neutrons are given off all the time. When you put enough of the isotope together or bombard the material with neutrons that cause the isotope to keep a self-sustained reaction of neutrons going the isotope is said to reach super criticality and gives off a great deal of energy and radiation. It is the principle behind a nuclear bomb. You put enough of the isotope together just below super criticality and by some method cause the material reach super criticality. That is why the bomb does not just go off sitting on top a missile. It is just below criticality. The implosion is enough to put enough of the isotope in a denser area thus allowing for the self-sustained reaction to occur. I read once that this was called, "tickling the tail of the dragon."

- surface burst-a surface burst is a nuclear explosion where the fireball reaches the ground. It causes more material to come down as fallout and leaves a crater. This method is used to destroy underground bunkers like command and control centers, missile silos, air fields, etc.

  T

- tamper-it is used to slow down the nuclear reaction to keep the reaction at super criticality longer which allows for more of the material to be used in the explosion. I would think it helps make it more efficient and more deadly. There are two forces at play here. One is the energy that is being created that wants to expand. The other is the implosion that is forcing the material to stay in proximity to allow for the self sustained reaction to keep producing more energy. Eventually the explosion wins out and the material will be blown apart where the material can not continue to produce more energy. If the material is blown apart before super criticality is reached then you have a "fizzle" and you do not have a nuclear explosion.

Glossary

- treatment-there is no real treatment to prevent death or certain cancers for now. You can take Iodine to flood your body with non-radioactive Iodine so the radioactive Iodine will not cause Thyroid cancer. That helps with just the Thyroid and not with other problems. Prevention is key. Do not eat or drink water that contains radioactive elements and use a decent shelter. If you get dosed with radiation remember you can treat the symptoms. Diarrhea and vomiting can cause you electrolyte problems which can kill by themselves. Drinking clean water with Gatorade, Pedalyte or others added can help you keep your electrolytes balanced. Tylenol and Aspirin can keep fever down and deal with headaches. Antibiotics can help with infections if you have those. Sun burn cream can help with sun burns and iron and Vitamin B12 can help replace some of the iron and Vitamin B12 that is needed for production of red blood cells. Anti-Oxidant foods and vitamins plus multiple vitamins can replace some of the vitamins lost from diarrhea and vomiting and they may help to prevent some cancers. These can help keep you more comfortable but will not "cure" you and remember you will need them again in the latent phase of radiation sickness. There are two others things you need to keep in mind. First would be to watch out for cataracts and the second would be flash blindness. They are two things I personally do not know what you could do to help or treat. Hospitals during this time may be unavailable or overfilled so there may not be any treatment except for what you can give yourself. Even if there is treatment you may perish anyway. The firemen at Chernobyl is a good example since they recieved treatment but still perished because of the high dose of radiation they received. You can read "Military Radiobiology" by Armed Forces Radiobiology Research Institute ISBN 0-12-184050-6 published by Academic Press Inc. in 1987 for more information on what chemicals have been used to help with radiation sickness even though they really didn't find anything because the chemicals were to toxic.

Glossary

- thermal energy-when a nuclear bomb goes off there is heat and light given off and this is caused by the thermal energy that is produced by the fission. This can cause flash blindness if a person is looking at the explosion. A person can be burned by the thermal energy and depending on what the person is wearing can leave burn patterns in there skin. On the presentation that is available on this site is a picture of a unfortunate Japanese woman from Hiroshima with a burn pattern on her back from her clothes. The heat can cause from first degree burns to third degree burns. Also the thermal energy can cause fires around the area of the explosion depending on the composition of the material in the area. Especially the combustible material. The fires may not kill you directly as well. When material burns it produces toxic smoke that can kill you as well. If you listen to the news, a lot people die from smoke inhalation as well as the toxic substances in the air due to what is being burned. It takes three things for a fire to burn: fuel, ignition source, and oxygen. So I have a theory as well, if there is a large exchange and a lot forest is burned that the oxygen levels may be lower and will remain low since there are not enough plants left for the oxygen/carbon dioxide exchange. That is one of the fears of burning in the Amazon is that the CO2 will increase and create a green house effect as well as the nuclear winter. I think the amount of material put into the air as well as the burning will make it very hard for the survivors. Maybe even impossible to live on the surface. The environmental impact can not be underestimated.

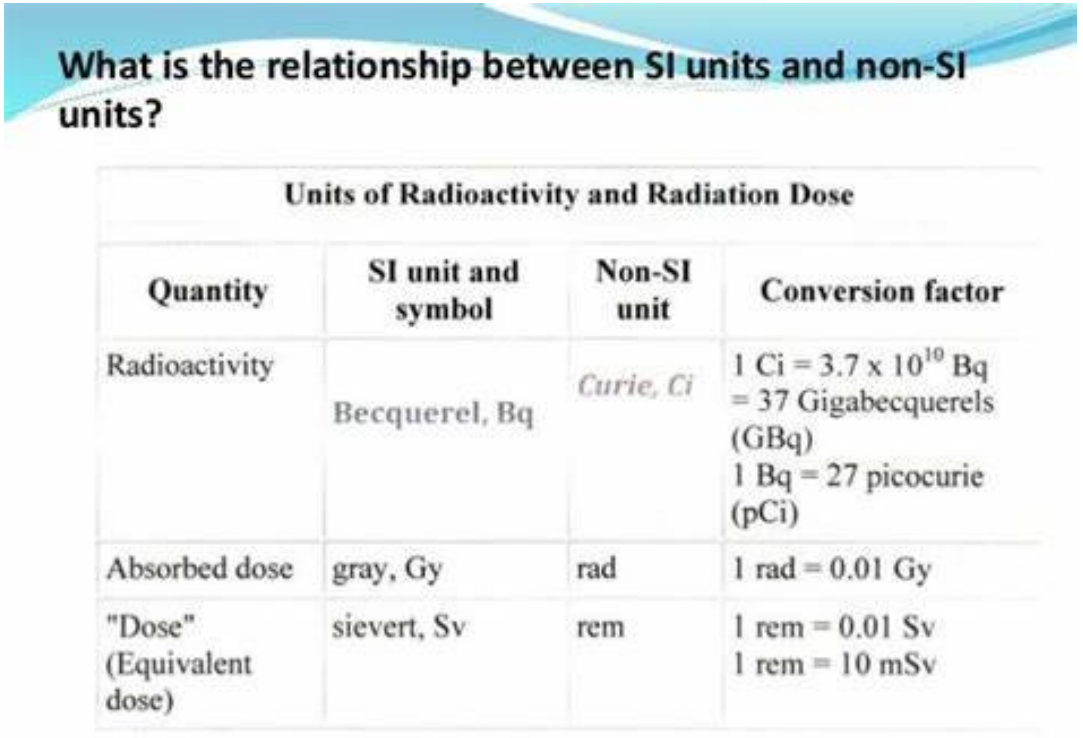
- thermonuclear blast-another name for hydrogen bomb. It uses fission to jump start a fusion reaction. Different forms of hydrogen are used in the fusion reaction. Hydrogen with a extra neutron is called Deuterium and hydrogen with two extra neutrons is called Tritium and both of these are used to create the fusion part of the thermonuclear bomb. A thermonuclear bomb can be in the megaton range and is a terrible bomb to be used.

Glossary

tritium-it another name for hydrogen with two extra neutrons in the nucleus which is used in a thermonuclear bomb.

U

- units of radiation-you can find some definitions at CDC and do some conversions at U.S. Department of Health and Human Services.



What is the relationship between SI units and non-SI units?

Units of Radioactivity and Radiation Dose

Quantity	SI unit and symbol	Non-SI unit	Conversion factor
Radioactivity	Becquerel, Bq	*Curie, Ci*	1 Ci = 3.7×10^{10} Bq = 37 Gigabecquerels (GBq) 1 Bq = 27 picocurie (pCi)
Absorbed dose	gray, Gy	rad	1 rad = 0.01 Gy
"Dose" (Equivalent dose)	sievert, Sv	rem	1 rem = 0.01 Sv 1 rem = 10 mSv

Glossary

- Uranium-half life of Uranium-235 is 703,800,000 years. When Uranium ore is mined it is more than 99% Uranium-238. High speed centrifuges are used to help remove the Uranium-235 from the ore for nuclear bombs. Of course it is a little more complicated than what I describe. The high speed centrifuges are used to refine Uranium for nuclear reactors as well as nuclear bombs and have been in the news. It is feared that Iran will use the high speed centrifuges to refine enough Uranium into weapons grade Uranium and make nuclear bombs. This scares a few people because of Iran's rhetoric of wanting to destroy Israel (the little Satan) and the United States (the big Satan). That is why secret high speed centrifuges are being searched for to see if they are making nuclear bombs.

  X

- x-rays-a nuclear explosion also gives off x-rays. On the electromagnetic spectrum they are lower in energy than gamma rays but right up there with them. Sometimes you might hear them called soft x-rays which are still x-rays but just have a little lower energy. See electromagnetic waves.

Emergency Supplies

- Canned Water and Collapsible Canteen
- Spoon and Fork
- Can Opener
- Bottle Opener
- Head Flashlight with Batteries
- Wearable Mosquito Repellent
- Water Purification Tablets
- Wire Hand Saw
- Glucose Tablets
- Zippo Lighter with Fuel
- Pocket Knife with Glass Breaker and Seat Belt Cutter
- Four in one Tool (Wistle,Thermo.,Compass,Mag.Glass)
- Bear Pepper Spray
- Boy Scout Mess Kit with Sterno Can
- Individual Bath Wipes or antimicrobial wipes

In a rolable backpack. Bare Necessities. Other equipment in car: clothes, tents, sleeping bags, electronic equipment in faraday cages, protection equipment, food, books and other literature, more canned water, foldable wagon, personal hygiene supplies.